FAA-E-2731D
October 17, 1988

U.S. Department of Transportation

**Federal Aviation Administration**

# Specification

Voice Switching and Control System

Product Specification

Production Phase

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LIST OF TABLES

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(d) External circuits: The VSCS will provide access to Public Switched Telephone Network (PSTN), and Federal Telecommunications System (FTS) and local telephone exchanges via an interface with the Private Automatic Branch Exchange (PABX) in the facility.

In this specification the VSCS is represented by the following functional areas:

(a) Entry/display: This area encompasses the communications control panels and data entry devices at the ATC controller and ancillary positions. Systems control inputs, circuit selection, and commands for connectivity are entered, interpreted, and processed while circuit status and system status indicators are supplied to the users on an interactive operational basis.

(b) Switching: This area encompasses the relationship between the electronic hardware and the operating system (program control). It is the area wherein command connect and related input (I)/output (0) data are resolved to implementation. Connectivity changes and validations in response to reconfiguration are also performed.

(c) Control: This area encompasses the hierarchical relationship of every VSCS component, function, and combinations thereof with respect to program control, including the reception of real-time data acquisition requests, real-time operating status, and real-time quality control. This functional area is defined by built-in algorithms, voice traffic management requirements, and interfaces with other major systems.

This division does not preclude the use of different types of architectures for the VSCS and is used for convenience in describing the VSCS functions.

## 1.2 DOCUMENT ORGANIZATION

This document is the engineering specification for the VSCS. Contained herein are the.requirements for intrafacility (intercom), interfacility (interphone), and A/G radio communications for air traffic control at the ACFs.

## 1.3 CROSS REFERENCING

Cross references, that is, references to parts within this specification and other documents, shall refer to the stated paragraph and all its subparagraphs.

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| NAS-IR-21024201 (part 1) | VSCS-ACCC(Processor to Processor) |
| NAS-IR-21014201 (part 2) | VSCS-ACCC(Common Console) IRD |
| NAS-IR-51034201 | VSCS-MPS IRD |
| NAS-IR-64024201 | VSCS-BUEC IRD |
| NAS-IR-42009404 | VSCS-PABX IRD |
| NAS-IR-42014201 | VSCS/TCS INTERPHONE IRD |
| NAS-IR-42004205 | VSCS-REC IRD |
| NAS-IR-92020000 | CTS/USER SYSTEMS IRD |
| NAS-IR-42014101 | VSCS-NMCE IRD |
| NAS-IR-80104201 | VSCS-Power IRD |
| NAS-IR-41024201 | VSCS-RCE IRD |
| vs-I-02 | VSCS-Weather IRD |
| VS-I-03 | VSCS-Existing Radio Interfaces ICD |
| vs-I-01 | VSCS-TRUNKS ICD |
| NAS-IR-44010002 | TRANSMISSION EQUIPMENT: ANALOG INTERFACE IRD |
| NAS-IR-21020000 | LCN-USER IRD |
| FAA Order 1600.54 | Security of FAA Automatic Data Processing Systems and Facilities |

## 2.3 MILITARY PUBLICATIONS

### 2.3.1 Military Specifications

| Document | Title |
|---|---|
| MIL-E-17555 | Electronic and Electrical Equipment, Accessories, and Repair Parts, Packaging and Packing of |

### 2.3.2 Military Standards

| Document | Title |
|---|---|
| DOD-STD-2167 | Defense System Software Development |
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| ANSI X3.66-1979 | American National Standard for Advanced Data Communication Control Procedures (ADCCP) |

2.5 INDUSTRY STANDARDS

| Document | Title |
|---|---|
| EIA-I S-4 | Transmission Loss Plan for a Mu-Law Compatible PBX |
| EIA-STD-RS-464 | Private Branch Exchange (PBX) Switching Equipment for Voiceband Applications |
| IEEE-488 | IEEE Standard Digital Interface for Programmable Instrumentation |
| IEEE-STD-743-1984 | IEEE Standard Methods and Equipment for Measuring the Transmission Characteristics of Analog Voice Frequency Circuits |
| NEC, NFPA-70 | National Electric Code 1987 |

2.6 FEDERAL STANDARDS

| Document | Title |
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| 29 CFR 1910 | OSHA Safety and Health Standard |

2.7 DOCUMENT PRECEDENCE

When conflicts exist between the requirements of the contract and this specification, the contract shall take precedence. When conflict exists between the requirements of this specification and its referenced documents, this specification shall take precedence. When the requirements of the U.S. Government Printing Office Style Manual conflict with the requirements (a) specified herein, or (b) in any other applicable FAA standards, requirements of this specification and other FAA specifications shall apply.

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Copies of this specification and other applicable FAA specifications, standards, and drawings may be obtained from the Contracting Officer in the Federal Aviation Administration Office issuing the invitation for bids or request for proposals. Requests should fully identify material desired, i.e., specification, standard, amendment, and drawing numbers. Requests should cite the invitation for bids, request for proposals, the contract

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# 3.0 REQUIREMENTS

## 3.1 GENERAL REQUIREMENTS

The VSCS shall be designed, developed, fabricated, tested, delivered, installed, integrated, cut over, and made fully operational in accordance with this specification and the contract schedule.

### 3.1.1 Definitions and Formulas

The definitions and related mathematical formulas for terms used herein shall be in accordance with Appendix I, Acronyms, Abbreviations, Definitions, Terms, and Formulas.

### 3.1.2 Equipment, Software, and Services to be Furnished

All necessary engineering, management, equipment, software, services, documentation, and testing shall be provided in accordance with this specification and the contract schedule.

### 3.1.3. System Design and Construction Features

The VSCS shall be designed and constructed using proven state-of-the-art, solid-state switching technology and standard components, circuits, software, and interfaces. The system design and construction shall meet the architectural and human factors requirements specified herein and the capacity, modularity, growth, and performance criteria specified in 3.2, System Characteristics.

3.1.3.1 **A/G** Backup Switch - The VSCS shall provide a separate switch to back up **the A/G** switching and control functions of the VSCS. The failure of the A/G function even at a single sector in the facility is unacceptable. However, as the facilities are expected to have at least 10% slack positions, the VSCS can mitigate intra VSCS A/G failures of up to 10% of the assigned frequencies, restoring A/G communications to all sectors. Beyond that point, switchover to the A/G backup switch will be required. Thus, in the event of a failure of the A/G primary switch, which causes 10% or more of the assigned frequencies to become nonoperational within a facility, the A/G primary switch shall be disconnected automatically, and the operational A/G backup switch shall assume those functions. The area-manager shall have the capability to manually activate and deactivate the A/G backup switch, thus transferring the A/G switching functions to and from the A/G backup switch. Separate paths for voice, control, and power shall be provided. The A/G backup switch shall be fully reconfigurable in accordance with 3.1.5, Reconfiguration Functions.

3.1.3.2 **Architecture** - The system architecture shall meet the operational, reliability, maintainability, availability (RMA) and performance requirements specified, plus the following three additional constraints:

3.1.3.2.1 Voice and Data Resource Constraints - The VSCS architecture shall have a sufficient number of simultaneous voice paths to carry maximum offered voice traffic and shall not cause blocking due to a lack of voice paths. However, blocking caused by control system and call processing shall not exceed the grade of service and throughput timing requirements of 3.2.

3.1.3.2.2 Adaptability - As the VSCS will function in a frequently changing environment, the system performance shall be maintained at the specified levels even if there are changes in the number and types of terminations, changes in the volume and mix of voice traffic, and changes in configurations (see 3.2). The additions and reductions to the on-line VSCS shall be implemented without disruption to unaffected system elements.

3.1.3.2.3 Failure Impact Limitation - The system architecture shall, by design, limit the impact of the failure of individual components to single functions (e.g., transmit (TX), receive (RX), direct access (DA)) and to single terminations (e.g., ground/ground (G/G) trunk, position, radio trunk).

3.1.3.3 Human-engineered VSCS Console Equipment - The VSCS design shall be in accordance with the human/system interface requirements of MIL-STD-1472 as specified in 3.4.

3.1.3.3.1 Reuse of VSCS Console Equipment - The interactive display panels and electronics box developed for use in the AAS common console shall also be used in existing controller consoles through adaptive mounting hardware. Any additional hardware required to provide temporary VCE use in the existing console shall meet the requirements of this specification.

3.1.3.4 Parts Policy - The VSCS parts policy shall follow the criteria of MIL-STD-1388-2 with tailoring to meet the higher reliability requirements of the specification.

3.1.4. ATC Communication Functions

3.1.4.1 Radio Communications and Control - The' VSCS shall provide radio communications switching and the capability to select and control radio transmitters, receivers, and transceivers located at either local or remote radio sites from the ATC positions via the Radio Control Equipment (RCE), or the existing radio interfaces. The required interface will be determined by the contractor at the time of the site survey. The VSCS will be capable of providing all specified functionality, with the exception of the receiver voting algorithm, with the existing radio interfaces. When the existing radio interfaces do not provide a required input to the VSCS, the required signal will be generated internal to the VSCS.

3.1.4.2 BUEC - The VSCS shall provide connectivity and control between BUEC classmarked positions to the BUEC priority module in accordance with

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3.1.6.2 Power Supply - The VSCS equipment shall draw power from the FAA-supplied power conditioning system (PCS). The VSCS shall operate from commercial at power in the event of PCS failure. Interface to power sources shall be as described in the VSCS-Power IRD (see 3.6.14).

3.1.6.3 Classmarks - The VSCS shall have a software-controlled class-marking capability to restrict functions and access for all positions and trunk circuits. Classmark requirements are specified in 3.5.4.1, Reconfiguration.

3.1.6.4 Numbering Plan - A comprehensive numbering plan, subject to FAA approval, shall be defined in accordance with the requirements in 3.3.2.2.12. Operational requirements, emphasizing simplicity and speed of dialing.

## 3.1.7 Interface Design Features

The VSCS design shall employ standard internal and external interfaces and protocols. External interfaces shall be as required in 3.6, Interfaces.

## 3.1.8 Telecommunication Interfaces

The VSCS shall provide telecommunications interfaces as detailed in the following paragraphs.

3.1.8.1 Backbone Microwave System - The VSCS shall interface with the backbone microwave system in accordance with the VSCS-Trunk IRD (see 3.6.8).

3.1.8.2 Leased Transmission Service - For communications to facilities that are not on the backbone microwave system, the VSCS shall interface with circuits leased from common carriers.

3.1.8.3 Telephone Networks - The VSCS shall provide access to external switched telephone networks (PSTN and FTS) through the administrative PABX collocated with VSCS within each facility.

3.1.8.4 Integrated Communications Switching System (ICSS) - The VSCS shall provide connectivity to ICSSs in accordance with the VSCS - Trunks ICD.

3.1.8.5 Tower Communications Switch (TCS) - The VSCS shall provide connectivity in accordance with the VSCS/TCS Interphone IRD.

3.1.8.6 Traffic Management Voice Switch (TMVS) - The VSCS shall provide connectivity to the TMVS located at the Central Flow Control Facility (CFCF) via standard trunks.

3.1.8.7 A/G Communications Network - The connectivities to remote A/G radio control facilities (RCFs) will be provided by standard trunks; signaling and control of radio trunks will be provided by either RCE or existing radio interfaces. The VSCS shall provide access to these facilities via either RCE or existing radio interfaces in accordance with the VSCS-RCE IRD (see 3.6.5) or the VSCS-Existing Radio Interfaces ICD (see 3.6.15). In the absence of the RCE, the facility access shall be via the existing radio interfaces.

### 3.1.9 Maintenance Functions

3.1.9.1 Maintenance Staffing Limit - The staffing goal for the VSCS is to maintain each system with one trained person available one shift per day. During the other two shifts, a maintenance person will be on call. The VSCS reliability and maintainability allocations to meet the availability specified in 3.2 shall be within this workforce limitation. Maintenance personnel other than at the site level (e.g., at the FAA Depot) are not counted in this workforce limit.

3.1.9.2 Fault Detection and Isolation - The VSCS shall provide fault detection and isolation including self-diagnostics and the capability to identify a failure; isolate the defective module, circuit, or trunk; automatically configure its function around the problem; and allow the isolated faulty module to be serviced without disrupting ATC operations. All detected faults shall be automatically reported to the maintenance position and Maintenance Processor System (MPS) (see 3.6.4) or a remote terminal for testing and correction.

3.1.9.3 Testing - The VSCS shall have the capability to initiate automatic and manual test routines. The VSCS shall monitor the results of automatic test routines from the maintenance position and through the remote terminal for any system elements identified by the fault isolation mechanism. The VSCS shall minimize the need for specialized test equipment by built-in, self-test features.

3.1.9.4 Certification - The VSCS shall have built-in test equipment (BITE) and built-in-test (BIT) software for on-line certification of the system as specified in 3.8, Certification, for the entire system, including position and backroom equipment. Critical parameters shall be measured, recorded, and compared with tolerance limits; a record highlighting out-of-tolerance conditions shall be provided.

### 3.1.10 Management Functions

3.1.10.1 ATC Operational Training - The VSCS functions and features that support operational training shall include operational monitoring, jack preemption, and operational recording at the supervisory positions.

3.1.10.2 Traffic Data Collection, Reduction, and Analysis - The VSCS shall

provide the capability for on-line voice traffic data collection and off-line reduction and analysis.

3.1.10.3 Security - The VSCS software design shall include security provisions to prevent unauthorized access to the system (see 3.11).

3.1.11 Software Features

All software shall have the following features: user-friendliness, modularity, transportability, reliability, testability, fail-soft/fail-safe, maintainability, and requirement testability. All software shall be well documented. Software shall meet the requirements stated in 3.10, Software.

3.1.11.1 Operating Systems - Commercially available computers within the VSCS environment shall be controlled by commercially available operating systems that are fully supported and maintained. Such operation systems shall be in a stable condition (not under development), in routine operation in an environment external to the contractor, and fully documented. Additionally, these operation systems shall support all peripheral devices in the VSCS design that are offered as accessories to the commercial computers. A commercially available support environment, compatible with the operating systems, shall be available to allow efficient development and maintenance of VSCS software. Such support shall incude, but not be limited to, one or more high-level languages, debugging and testing aids, text editors, and documentation aides.

3.1.11.2 Embedded Processors - Embedded processors in the VSCS shall be controlled by fully documented software. Commercially available support equipment and support environments shall be available to allow efficient development and maintenance of embedded VSCS software.

3.1.12 Alternate Standards

For existing systems, alternate industry standards employed in the areas of transmission parameters, off-the-shelf software development, and physical construction practices may be accepted, subject to FAA approval, when such alternate standards are determined by the FAA to be substantially equivalent to the FAA and Military Standards referenced in this specification.

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3.2.2.2.1.2 A/G PTT Indicator Response Time - The response time for this event shall be from the instant that a PTT confirmation signal is present at the RCE interface with the VSCS, to the instant that indicator response is activated at the calling position. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

In the absense of the RCE and the existing radio interfaces do not supply a PTT confirmation, the response time from this event shall be from the instant the PTT confirmation signal is generated by the VSCS Radio Interface equipment to the instant that the indicator response is activated at the calling position. For 95% of the event completions, this event response time shall not exceed 50ms. For 99.99% of the event completions, this event response time shall not exceed 100ms.

## Table I. Operational Environments

| Sizing Parameter | Initial No. Required Minimum | Initial No. Required Maximum | Maximum Future Sizing |
|---|---|---|---|
| Positions | 50 | 340 | 430 |
| Interfacility Trunks (Inteiphone) | 50 | 450 | 570 |
| Radio Interfaces | 50 | 300 | 350 |
| PABX Tielines | 12 | 30 | 40 |
| BUEC Interfaces | 25 | 100 | 240 |
| Weather Tielines | 6 | 15 | 18 |

note: The data under "Minimums" represent a generic Minimum System, but does not preclude zero for any item. The contract schedule defines exact sizing for each site.

Table II. Grades of Service and Average Traffic Loads Per Position During Peak Busy Hour (PBH) and Peak Busy Minute (PBM)*

| Function | Grade of Service | Holding Time, s** | Erlangs (PBH) | Calls/ Hour During PBH*** | Erlangs (PBM) | Calls/ Minute During PBM*** |
|---|---|---|---|---|---|---|
| PTT (A/G)**** | Non-blocking | 4 | 0.13 | 117 | 0.234 | 3.5 |
| Main/ Standby | 0.001 | | | 4 | | 0.2 |
| TX/RX IC | 0.001 | 20 | 0.06 | 11 | 0.36 | 1.1 |
| IP | 0.001 | 20 | 0.06 | 11 | 0.36 | 1.1 |
| PABX Access | 0.05 | 180 | 0.03 | <1 | 0.06 | 0.02 |
| Weather***** | 0.001 | 30 | 0.033 | 4 | N/A | N/A |

*The traffic coming in the other direction is assumed to be symmetrical, except for weather which is one way only.
**Distribution for holding times is exponential.
***Distribution for arrival rates is Poisson.
****PTT (A/G) can be destined for either RCE or existing radio interfaces.
*****Weather traffic load applies to A/G positions only.

Table IIa. PBH and PBM Call Distribution

| Function | Call Mode | Percentage of Usage |
|---|---|---|
| PTT (A/G)[1] | Controller Generated PTT | 100% |
| IC | non-OVR | 15% |
| | OVR | 85% |
| IP | non-OVR | 25% |
| | OVR | 75% |

[1] Assume for loading analysis, 20% of the A/G frequencies are cross-coupled.

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| Weather***** | 0.001 | 30 | 0.033 | 4 | N/A | N/A |

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| IP | non-OVR | 25% |
| | OVR | 75% |

[1] Assume for loading analysis, 20% of the A/G frequencies are cross-coupled.

| | |
|---|---|
| IC Call Operation Indicator | 275 |
| IC Call Ringback Tone | 200 |
| IC Busy Tone | 200 |
| Conference Call Deselect | 200 |
| Conference Call Indicator | 200 |
| Hold/Resume | 200 |
| Call Forward Select | 200 |
| Call Forward Deselect | 200 |
| Call Forward Select Confirmation | 270 |
| Unacceptable Call Forward Alert | 270 |
| Call Transfer Select | 210 |
| Unacceptable Call Transfer Alert | 210 |
| Answer From Common Answer Queue | 200 |
| Confirm Calls in Common Answer Queue | 200 |
| Position Voice Monitor Selection | 200 |
| Voice Monitor Selection Confirmation | 250 |
| PBX Beep Cycle | |

*Where applicable, response times exclude TED detection time and display device response times.

**A tolerance of 10 ms or 50% of the maximum response time, whichever is greater, is allowable for the 95% event completion maximum response time to accommodate the response time characteristics peculiar to each system architecture. There is no exception to the 99.99% event completion response time requirements.

3.2.2.2.1.3 System-Generated A/G PTT Transmit Response Time - The response time for this event shall be from the instant that a request for a feature which requires a system-generated A/G PTT is present in the VSCS, to the instant that an A/G PTT signal is present at the A/G interface with the vscs. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.1.4 A/G PTT Release Transmit - The response time for this event shall be from the instant that the A/G PTT activation is terminated at the position, to the instant that the A/G PTT signal is no longer present at the A/G interface with the VSCS. For 95% of the event completions, this response time shall not exceed 15 ms. For 99.99% of the event completions, this response time shall not exceed 30 ms. If voice delay exceeds the specified A/G PTT release time, then the actual response time shall not exceed the voice delay + 4 ms for both the 95% and 99.99% event completions.

3.2.2.2.1.5 A/G PTT Release Indicator - The response time for this event shall be from the instant that a PTT confirmation signal is no longer present at the A/G interface with the VSCS, to the instant that indicator response is deactivated at the position. For 95% of'-the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

In the absence of the RCE, and the existing radio interfaces do not supply the PTT confirmation signal, the response time for this event-shall be from the instant the PTT release signal is generated by the VSCS radio interface equipment to the instant that the indicator response is deactivated at the position. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.1.6 Frequency Selection - The response time for this event shall be from the instant a request for a frequency selection is initiated at the position to the instant that the selected assigned frequency is enabled at the position. For 99.99% of the event completions, this event response time shall not exceed,230 ms.

3.2.2.2.1.7 Frequency Deselection - The response time for this event shall be from the instant a request is initiated at the position to the instant the selected assigned frequency is disabled at the position. For 99.99% of the event completions, this event response time shall not, exceed 230 ms.

3.2.2.2.1.8 Cross Coupling Selection - The response time for this event shall be from the instant a request for enabling cross-coupling of the designated frequencies is made at the position to the instant the selected frequencies are coupled. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.1.3 System-Generated A/G PTT Transmit Response Time - The response time for this event shall be from the instant that a request for a feature which requires a system-generated A/G PTT is present in the VSCS, to the instant that an A/G PTT signal is present at the A/G interface with the vscs. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.1.4 A/G PTT Release Transmit - The response time for this event shall be from the instant that the A/G PTT activation is terminated at the position, to the instant that the A/G PTT signal is no longer present at the A/G interface with the VSCS. For 95% of the event completions, this response time shall not exceed 15 ms. For 99.99% of the event completions, this response time shall not exceed 30 ms. If voice delay exceeds the specified A/G PTT release time, then the actual response time shall not exceed the voice delay + 4 ms for both the 95% and 99.99% event completions.

3.2.2.2.1.5 A/G PTT Release Indicator - The response time for this event shall be from the instant that a PTT confirmation signal is no longer present at the A/G interface with the VSCS, to the instant that indicator response is deactivated at the position. For 95% of'-the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

In the absence of the RCE, and the existing radio interfaces do not supply the PTT confirmation signal, the response time for this event-shall be from the instant the PTT release signal is generated by the VSCS radio interface equipment to the instant that the indicator response is deactivated at the position. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.1.6 Frequency Selection - The response time for this event shall be from the instant a request for a frequency selection is initiated at the position to the instant that the selected assigned frequency is enabled at the position. For 99.99% of the event completions, this event response time shall not exceed,230 ms.

3.2.2.2.1.7 Frequency Deselection - The response time for this event shall be from the instant a request is initiated at the position to the instant the selected assigned frequency is disabled at the position. For 99.99% of the event completions, this event response time shall not, exceed 230 ms.

3.2.2.2.1.8 Cross Coupling Selection - The response time for this event shall be from the instant a request for enabling cross-coupling of the designated frequencies is made at the position to the instant the selected frequencies are coupled. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

not exceed 100ms.

3.2.2.2.4 Receiver Muting Response Times

3.2.2.2.4.1 Remote Receiver Muting Response Time - The response time for this event shall be from the instant that the remote receiver muting signal is generated at a position, to the instant that this signal is present at the A/G interface with the VSCS. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms. Remote receiver muting is not used with some existing radio interfaces.

3.2.2.2.4.2 Remote Receiver Muting Confirmation Response Time - The response time for this event shall be from the instant that the muting confirmation signal is present at the A/G interface with the VSCS, to the VSCS, to the instant that an indicator response signal is activated at the position that generated the remote receiver muting signal. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

In the absence of the RCE, and the existing radio interfaces do not supply a remote receiver muting confirmation signal, the response time for this event shall be from the instant the remote receiver muting confirmation signal is generated by the VSCS radio interface equipment to the instant that an indicator response is activated at the position that generated the remote receiver muting signai. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms. Remote receiver muting is not used with some existing radio interfaces.

3.2.2.2.4.3 Remote Receiver Mute Deselect - The response time for this event shall be from the instant a request is initiated at the position to the instant that Receiver Remote Muting Deselect signal is present at the A/G interface. For 99.99% of the event completion, this event response time shall not exceed 120 ms. Remote receiver muting is not used with some existing radio interfaces.

3.2.2.2.4.4 Remote Receiver Mute Deselect Indicator - The response time for this event shall be from the instant that a Receiver Remote Muting deselect signal is present at the A/G interface with the VSCS, to the instant that a visual indication of remote receiver muting deselection on a specific frequency is received at the position display device. For 99.99% of the event completion, this event response time shall not exceed 200 ms.

In the absence of RCE, and the existing radio interfaces do not supply a remote receiver muting deselect confirmation signal, the response time for this event shall be from the instant the remote receiver muting deselect confirmation signal is generated by the VSCS radio interface equipment to the instant that a visual indication of remote receiver muting deselection on a specific frequency is received at the position display device. For 99.99% of the event completions, this event response time shall not exceed

200 ms. Remote receiver muting is not used with some existing radio interfaces.

3.2.2.2.4.5 Local Receive Muting Select - The response time for this event shall be from the instant a request is initiated at the position to the instant that the selected frequency audio voice signal is muted at the position. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.4.6 Local receive Mute Select Indicator - The response time for this event shall be from the instant a request is-initiated at the position, to the instant that a visual indication of local receiver muting selection on a specific frequency appears on the position display device. For 99.99% of the event completions, this event response time shall not exceed 300 ms.

3.2.2.2.4.7 Local Receive Muting Deselect - The response time for this event shall be from the instant a request is initiated at the position to the instant that the selected frequency audio voice signal is enabled at the position. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.4.8 Local Receive Mute Deselect Indicator - The response time for this event shall be from the instant a request is initiated at the position, to the instant that a visual indication of local receive muting deselection on a specific frequency appears on the position display device. For 99.99% of the event completions, this event response time shall not exceed 300 ms.

3.2.2.2.5 Site Selection Response Time

3.2.2.2.5.1 Frequency Site Selection - The response time for this event shall be from the instant a request for change in frequency site selection is initiated at the position to the instant the selected site is enabled. For 99.99% of the event completions, this event response time shall not exceed 115 ms. + 3 instant OSCs applies equal to RCE

3.2.2.2.5.2 Frequency Site Confirmation - The response time for this event shall be from the instant a frequency site selection is enabled to the instant a VSCS-generated confirmation of site transer is received at the requesting operational position. For 99.99% of the event completions, this event response time shall not exceed 115 ms.

3.2.2.2.6 G/G PTT Transmit and Indicator Response Time

3.2.2.2.6.1 G/G PTT Transmit Response Time - The response time for this event shall be from the instant that a G/G PTT signal is generated at the position, to the instant that voice transmission over the established path can begin. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms. Delays outside the VSCS are not included.

3.2.2.2.6.2 G/G PTT Release Response Time - The response time for this event shall be from the instant that the G/G PTT signal is terminated at the position, to the instant that voice transmission ceases from the position. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms. Delays outside the VSCS are not included.

3.2.2.2.7 IC Setup Response Time

3.2.2.2.7.1 IC Call Placement Response Time - The response time for this event, whether it be a two-party IC call or an IC addition to a progressive or preset conference call, shall be from the instant that the address is generated at the position, to the instant that the called position is notified by appropriate VSCS internal signaling. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.7.2 IC Call Acceptance Response Time - The response time for this event, whether it be a two-party IC call or an IC addition to a progressive or preset conference call, shall be from the instant that the called position accepts the IC call, to the instant that an indicator response (ringback tone stops) is activated at the calling position, and voice communications over the established path can begin. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.7.3 IC OVR Call Placement/Acceptance Response Time - The response time for these events shall be from the instant that the address is generated at the position, to the instant that the Calling (Placement) and the Called (Acceptance) positions are notified and voice communications can begin over the OVR voice channel established between the positions. For 95% of the event completions, these response times shall not exceed 50 ms. For 99.99% of these event completions, these response times shall not exceed 100 ms.

3.2.2.2.8 IC Circuit Release Time Delay - The response time for this event shall be from the instant that the release signal is emitted at the releasing position, to the instant that the voice circuit is released, the associated positions are released from this connection, and the affected positions receive proper indicator response. For 96% of the event completions, this event response time shall not exceed 100 ms. For 99.99% of the calls terminated, this event response time shall not exceed 200 ms.

3.2.2.2.8.1 I A & I A Override Selection (IC) - The response time for this event shall be from the instant that a valid 'IA" keypress on the position IA keypad is initiated to the instant that IA keypad is available for input (regardless of whether OVR or not). This includes clearing of keypad display reset of any previously entered number sequences, and release of any

active G/G calls. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.8.2 IC Call Operation Indicator - The response time for this event shall be from the instant that a request is initiated at the position to the instant that visual indication of IC call appears on both the originating and terminating position display devices. For 99.99% of the event completions, this event response time shall not exceed 275 ms.

3.2.2.2.8.3 IC Call Ringback Tone - The response time for this event shall be from the instant that a valid address is initiated at the position (IA/DA) to the instant that a ring back tone is connected to the position. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.8.4 IC Busy Tone - The response time for this event shall be from the instant that a valid address is generated at the position (IA/DA) to the instant that a busy tone is connected to the position. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.9 IP Call Setup Response Time

3.2.2.2.9.1 IP Call Placement Response Time

3.2.2.2.9.1.1 Position-to-trunk IP Call Placement Response Time - The response time for this event, whether it be an individual position-to-trunk IP call or an IP addition to a progressive or preset conference call, shall be from the instant that the address is generated at the position, to the instant that any signaling is initiated at the trunk interface. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.9.1.2 Trunk-to-position IP Call Placement Response Time - The response time for this event shall be from the instant that the complete called address is confirmed at the trunk interface to the VSCS, to the instant that the called position is notified (by a call indicator response). For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.9.1.3 Position-To-Trunk IP OVR Call Placement Response Time - The response time for this event shall be from the instant that the address. is generated at the position, to the instant that appropriate OVR signalling is initiated at the Trunk Interface. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.9.1.4 Trunk-To-Position IP OVR Call Acceptance Response Time - The response time for this event shall be from the instant that appropriate IP OVR signalling is confirmed at the Trunk Interface, to the instant that the called position is notified of the call by appropriate VSCS internal

active G/G calls. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.8.2 IC Call Operation Indicator - The response time for this event shall be from the instant that a request is initiated at the position to the instant that visual indication of IC call appears on both the originating and terminating position display devices. For 99.99% of the event completions, this event response time shall not exceed 275 ms.

3.2.2.2.8.3 IC Call Ringback Tone - The response time for this event shall be from the instant that a valid address is initiated at the position (IA/DA) to the instant that a ring back tone is connected to the position. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.8.4 IC Busy Tone - The response time for this event shall be from the instant that a valid address is generated at the position (IA/DA) to the instant that a busy tone is connected to the position. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.9 IP Call Setup Response Time

3.2.2.2.9.1 IP Call Placement Response Time

3.2.2.2.9.1.1 Position-to-trunk IP Call Placement Response Time - The response time for this event, whether it be an individual position-to-trunk IP call or an IP addition to a progressive or preset conference call, shall be from the instant that the address is generated at the position, to the instant that any signaling is initiated at the trunk interface. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.9.1.2 Trunk-to-position IP Call Placement Response Time - The response time for this event shall be from the instant that the complete called address is confirmed at the trunk interface to the VSCS, to the instant that the called position is notified (by a call indicator response). For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.9.1.3 Position-To-Trunk IP OVR Call Placement Response Time - The response time for this event shall be from the instant that the address. is generated at the position, to the instant that appropriate OVR signalling is initiated at the Trunk Interface. For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.9.1.4 Trunk-To-Position IP OVR Call Acceptance Response Time - The response time for this event shall be from the instant that appropriate IP OVR signalling is confirmed at the Trunk Interface, to the instant that the called position is notified of the call by appropriate VSCS internal

shall be from the instant that the operator's touch action occurs, to the instant that the touch action has been detected. For 99.99% of the event completions, this event response time shall not exceed 50 ms.

3.2.2.2.14 Radio Squelch Break Response Time - The response time for this event shall be from the instant that the squelch break signal is received at the A/G interface of the VSCS to the instant the audio path is set up from the A/G interface of the VSCS to the position(s). In the absence of RCE, and the existing radio interfaces do not provide a squelch break signal, or when the frequency is selected to BUEC, the VSCS shall interpret the reception of voice signals from the existing radio interface or BUEC interface as a squelch break and shall set up the audio path between the VFSS interface and the position(s). For 95% of the event completions, this event response time shall not exceed 15 ms. For 99.99% of the event completions, this event response time shall not exceed 30 ms.

3.2.2.2.15 Radio Squelch Break Indication Response Time - The response time for this event shall be from the instant the squelch break signal is received or generated at the VSCS A/G or BUEC interface to the instant the squelch break indication is presented at the position(s). For 95% of the event completions, this event response time shall not exceed 50 ms. For 99.99% of the event completions, this event response time shall not exceed 100 ms.

3.2.2.2.16 Conference Call Operation/Conference Call Deselect - The response time for this event shall be from the instant that a valid release action is initiated at the position to the instant that the releasing conference participant voice path is dropped from the conference. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.17 Conference Call Indicator - The response time for this event shall be from the instant that a valid operator action is initiated at the position (This action may include a single touch action, entry of appropriated IA function code sequence, or both), to the instant that visual indication of conference call initiation appears on the position display device. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.18 Call Hold Operation -- Hold/Resume - The response time for this event shall be from the instant that valid operator action is initiated at the position, to the instant that the:

a. Held call audio voice path is reconnected to the position (if resume action initiated)
b. Active call audio path is disconnected to position (if hold action initiated).

For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.19 Call Forward Operation/Call Forward Select - The response time for this event shall be from the instant that valid operator action is initiated at the position, this action shall include either a single touch action to a DA designator, or entry of the destination position number on the IA keypad, to the instant that the call forwarding function is engaged at the position. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.20 Call Forward Deselect - The response time for this event shall be from the instant that the valid IA function code sequence is initiated at the position, to the instant that the call forwarding function is disengaged at the position. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.21 Call Forward Select Confirmation - The response time for this event shall be from the instant that valid operator action is initiated at the position, this action may include either a single touch action to a DA designator, or entry of the destination position number on the IA keypad, to the instant that the visual confirmation of call forwarding activation appears on the position display device. For 99.99% of the event completions, this event response time shall not exceed 270 ms.

3.2.2.2.22 Unacceptable Call Forward Alert - The response time for this event shall be from the instant that valid operator request is initiated at. the position, this action may include a either single touch action to a DA designator, or entry of the destination position number on the IA keypad, to the instant that an alert action (audio or visual) is engaged at the position. For 99.99% of the event completions, this event response time shall not exceed 270 ms.

3.2.2.2.23 Call Transfer Operation/Call Transfer Selection - The response time for this event shall be from the instant that the valid operator request is initiated at the position, this action may include either a single touch action to a DA designator, or entry of the designation, position number on the IA keypad, to the instant an indication is given to the transferred-to position. For 99.99% of the event completion, this event response time shall not exceed 210 ms.

3.2.2.2.24 Unacceptable Call Transfer Alert - The response time for this event s'hall be from the instant that a valid operator request is initiated at the position, this action may include either a single touch action to a DA designator, or entry of the destination position number on the IA keypad, to the instant that an alert action (audio or visual) is engaged at the position. For 99.99% of the event completions, this event response time shall not exceed 210 ms.

3.2.2.2.25 Common Answer Queue/Answer From Common Answer Queue - The response time for this event shall be from the instant that valid operator select request of call in answer queue is initiated at the position (either

specified call or longest held call), to the instant that the selected held call's audio voice path is available at the position. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.26 Confirm Calls in Common Answer Queue - The response time for this event shall be from the instant that valid IA call is placed in the CA queue of the called position, to the instant that a visual indication of incoming IA call appears on the called position's display device. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.27 Position Voice Monitor

3.2.2.2.27.1 Position Voice Monitor Selection - The response time for this event shall be from the instant that a valid operator action is initiated at the position, this action may include either a single touch action to a DA designator, or entry of an IA function code and position identifier number, to the instant that the selected position's audio voice path is available at the monitoring position. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.27.2 Voice Monitor Selection Confirmation - The response time for this event shall be from the instant that a valid operator action is initiated at the position, this action may include a single touch action to a DA designator, or entry of an IA function code and position identifier number, to the instant that visual indication of voice monitor activation appears on the monitoring position's display device. For 99.99% of the event completions, this event response time shall not exceed 250 ms.

3.2.2.2.28 Voice Delay - The VSCS one-way intrafacility voice delay time shall not exceed 40 msec for 95% of the event completions, during the PBM and PBH conditions. specified in Table II and Table IIa. For 99.99% of the event completions, the VSCS one-way intrafacility voice delay time shall not exceed 70 msec, during the PBM and PBH conditions specified in Table II and Table IIa.

3.2.2.2.28.1 Intrafacility Voice Delay Measurement - The one-way voice measurement shall be from the instant voice enters the transmitting port (position, trunk, or radio port) to the instant the voice is received at the output of the receiving port (position, trunk, or radio port). When PTT is required for voice transmission, the voice delay test signal shall be sent for measurement after the A/G or G/G PTT transmit response time (as specified in Table III) has elapsed.

3.2.2.2.28.1.1 Position to Position Voice Delay Measurement - The position to position one-way voice delay measurement shall be from the instant that voice is present at the transmitting position's microphone to the instant that the voice is received at the receiving position's headset or loudspeaker.

specified call or longest held call), to the instant that the selected held call's audio voice path is available at the position. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.26 Confirm Calls in Common Answer Queue - The response time for this event shall be from the instant that valid IA call is placed in the CA queue of the called position, to the instant that a visual indication of incoming IA call appears on the called position's display device. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.27 Position Voice Monitor

3.2.2.2.27.1 Position Voice Monitor Selection - The response time for this event shall be from the instant that a valid operator action is initiated at the position, this action may include either a single touch action to a DA designator, or entry of an IA function code and position identifier number, to the instant that the selected position's audio voice path is available at the monitoring position. For 99.99% of the event completions, this event response time shall not exceed 200 ms.

3.2.2.2.27.2 Voice Monitor Selection Confirmation - The response time for this event shall be from the instant that a valid operator action is initiated at the position, this action may include a single touch action to a DA designator, or entry of an IA function code and position identifier number, to the instant that visual indication of voice monitor activation appears on the monitoring position's display device. For 99.99% of the event completions, this event response time shall not exceed 250 ms.

3.2.2.2.28 Voice Delay - The VSCS one-way intrafacility voice delay time shall not exceed 40 msec for 95% of the event completions, during the PBM and PBH conditions. specified in Table II and Table IIa. For 99.99% of the event completions, the VSCS one-way intrafacility voice delay time shall not exceed 70 msec, during the PBM and PBH conditions specified in Table II and Table IIa.

3.2.2.2.28.1 Intrafacility Voice Delay Measurement - The one-way voice measurement shall be from the instant voice enters the transmitting port (position, trunk, or radio port) to the instant the voice is received at the output of the receiving port (position, trunk, or radio port). When PTT is required for voice transmission, the voice delay test signal shall be sent for measurement after the A/G or G/G PTT transmit response time (as specified in Table III) has elapsed.

3.2.2.2.28.1.1 Position to Position Voice Delay Measurement - The position to position one-way voice delay measurement shall be from the instant that voice is present at the transmitting position's microphone to the instant that the voice is received at the receiving position's headset or loudspeaker.

Table IV. System Errors

| Description | Maximum Error Rate |
|---|---|
| False Service Disconnect | 10 (to the negative 6 power) |
| False Request For Service | 10 (to the negative 6 power) |
| Incorrect Dial Code Access | 10 (to the negative 6 power) |
| Push-to-Talk Error | 10 (to the negative 10 power) |

I 3.2.2.3.1 False Service Disconnects - For 10 (to the 6 power) calls transmitted throughout the system, not more than one false disconnect of a circuit shall occur due to any internal VSCS errors.

I 3.2.2.3.2 False Request for Service - For each 10 (to the 6 power) user
I requests for service, not more than one false request for service shall be
I initiated by internal VSCS errors.

3.2.2.3.3 Incorrect Dial Code Access - The VSCS error rate for transmitting or decoding addresses shall not exceed one erroneous call per 10 (to the 6 power) calls.

3.2.2.3.4 PTT Error Rate - The VSCS error rate for PTT activation and PTT release shall not exceed 10 (to the negative 10 power).

3.2.2.4 Reconfiguration Timing Requirements - After the VSCS receives the reconfiguration command, the VSCS shall be capable of reconfiguring the functional operations on either a position or facility level. During reconfiguration, a position shall not be without functional operations for more than 1 second under 50% of the PBH traffic conditions. Sector and area-level reconfiguration time shall not exceed the summation of position reconfiguration times for those positions affected by the reconfiguration. The reconfiguration of the entire facility shall not require more than 5 minutes under 50% of the PBH traffic conditions. The sector-, area-, and facility-level reconfiguration timing requirements shall exclude delays caused by a position(s) being engaged in an active call.

3.2.2.5 Degraded Operation - If either unanticipated emergency traffic conditions exceed VSCS traffic capabilities or internal system failures occur, then the VSCS shall service requests on a priority basis to ensure air safety. The VSCS shall assign highest priority to all A/G communications. After A/G communications, the VSCS shall assign decreasing priorities according to the following order: IC; IP; maintenance functions; data collection functions; and support functions, which receive lowest priority.

3.2.2.6 Voice Channel Performance Characteristics - The VSCS voice channel
I performance shall meet the requirements of the following paragraphs.

3.2.2.6.1 Impedance - Each voice frequency (VF) circuit within the system shall present a nominal impedance to its interface in accordance with the
I requirements set forth in the interface IRDs.

3.2.2.6.2 Background Noise - Combined hum and noise level of any single voice path within a VSCS, measured at the position jacks or at the voice path interfaces with external equipment, with both ends of the path properly terminated, shall not exceed 16 dBrnc for the C-message weighted noise and
I 35 dBrn for the 3-kHz flat noise. This test shall be performed with the AGC

I 3.2.2.3.1 False Service Disconnects - For 10 (to the 6 power) calls transmitted throughout the system, not more than one false disconnect of a circuit shall occur due to any internal VSCS errors.

I 3.2.2.3.2 False Request for Service - For each 10 (to the 6 power) user
I requests for service, not more than one false request for service shall be
I initiated by internal VSCS errors.

3.2.2.3.3 Incorrect Dial Code Access - The VSCS error rate for transmitting or decoding addresses shall not exceed one erroneous call per 10 (to the 6 power) calls.

3.2.2.3.4 PTT Error Rate - The VSCS error rate for PTT activation and PTT release shall not exceed 10 (to the negative 10 power).

3.2.2.4 Reconfiguration Timing Requirements - After the VSCS receives the reconfiguration command, the VSCS shall be capable of reconfiguring the functional operations on either a position or facility level. During reconfiguration, a position shall not be without functional operations for more than 1 second under 50% of the PBH traffic conditions. Sector and area-level reconfiguration time shall not exceed the summation of position reconfiguration times for those positions affected by the reconfiguration. The reconfiguration of the entire facility shall not require more than 5 minutes under 50% of the PBH traffic conditions. The sector-, area-, and facility-level reconfiguration timing requirements shall exclude delays caused by a position(s) being engaged in an active call.

3.2.2.5 Degraded Operation - If either unanticipated emergency traffic conditions exceed VSCS traffic capabilities or internal system failures occur, then the VSCS shall service requests on a priority basis to ensure air safety. The VSCS shall assign highest priority to all A/G communications. After A/G communications, the VSCS shall assign decreasing priorities according to the following order: IC; IP; maintenance functions; data collection functions; and support functions, which receive lowest priority.

3.2.2.6 Voice Channel Performance Characteristics - The VSCS voice channel
I performance shall meet the requirements of the following paragraphs.

3.2.2.6.1 Impedance - Each voice frequency (VF) circuit within the system shall present a nominal impedance to its interface in accordance with the
I requirements set forth in the interface IRDs.

3.2.2.6.2 Background Noise - Combined hum and noise level of any single voice path within a VSCS, measured at the position jacks or at the voice path interfaces with external equipment, with both ends of the path properly terminated, shall not exceed 16 dBrnc for the C-message weighted noise and
I 35 dBrn for the 3-kHz flat noise. This test shall be performed with the AGC

Table V. Frequency Response Characteristics

| Frequency, kHz | Maximum Power Below Zero Transmission Level Point, dB |
|---|---|
| 3.955 to 4.005 | -31 (18 dB below - 13 dBm) |
| 4.0 to 10.0 | -16 |
| 10.0 to 25.0 | -24 |
| 25.0 to 40.0 | -36 |
| Above 40.0 | -50 |

Table VI. Intermodulation Distortion

| Connection | Decibels Below Received Power (max), dB | |
|---|---|---|
| | R2* | R3** |
| Position to Position | 40 | 43 |
| Position to Trunk | 45 | 53 |

*R2 is the average of the power level in the 503- to 537-Hz and 2223- to 2257-Hz bands expressed in dB below the received power level.
**R3 is the total power in the 1877- to 1923-Hz band expressed in dB below the received power level.

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Table VII. Longitudinal Balance

| Frequency, Hz | Minimum Balance, dB |
|---|---|
| 300 | 58 |
| 500 | 58 |
| 1000 | 58 |
| 3000 | 53 |

Table VIII. Gain Tracking Linearity

| Input Level, dBm0 | Gain Deviation (max), dB |
|---|---|
| +3 to -37 | +/- 0.5 |
| -37 to -50 | +/- 1.0 |

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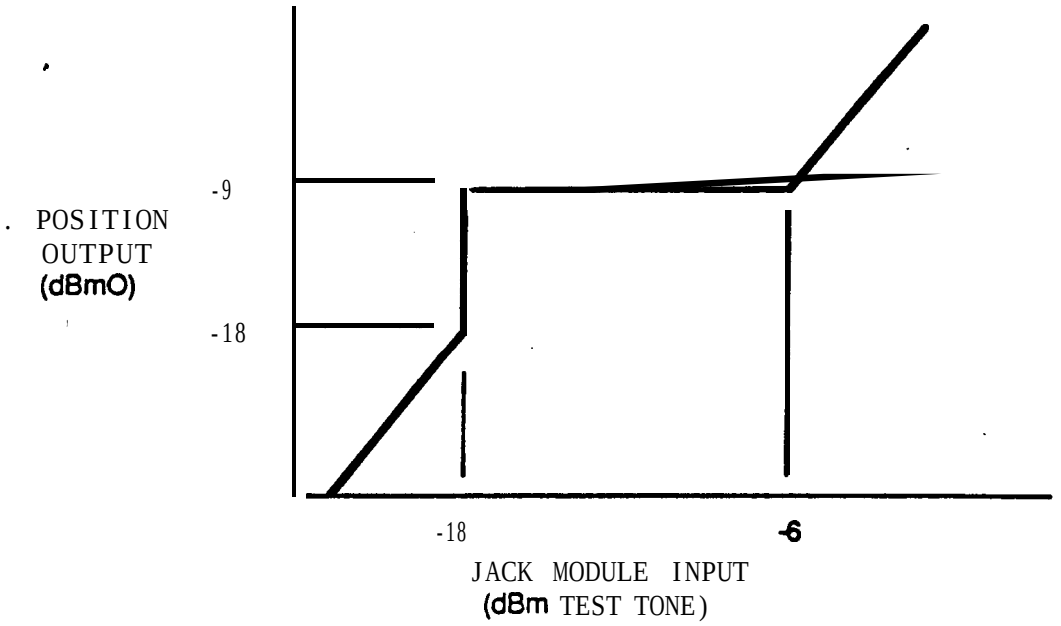


Figure 3-1A. Transmit Transfer Function

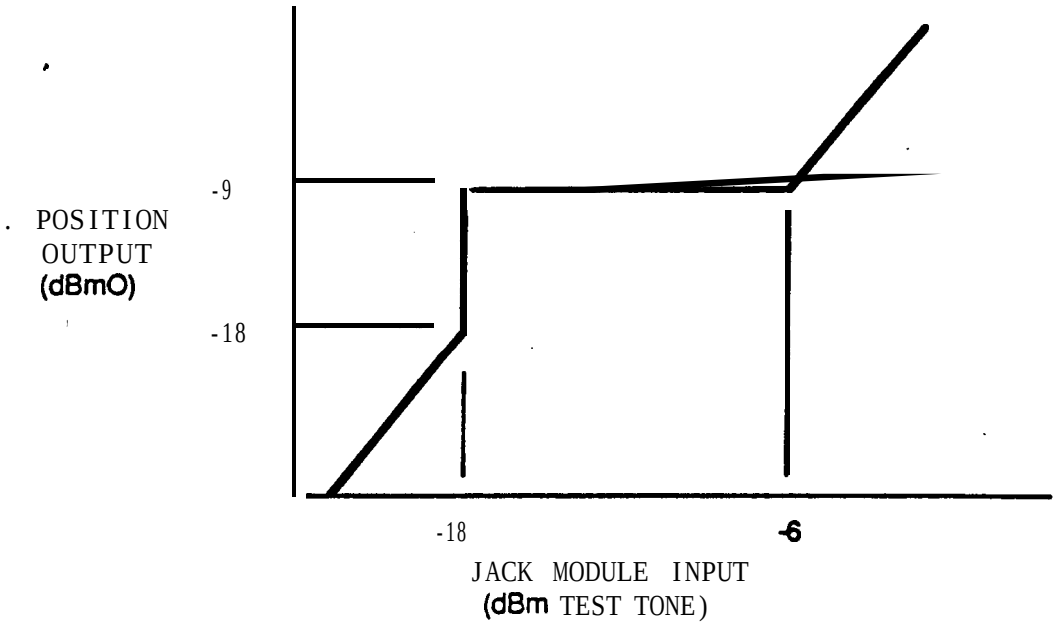


Figure 3-1A. Transmit Transfer Function

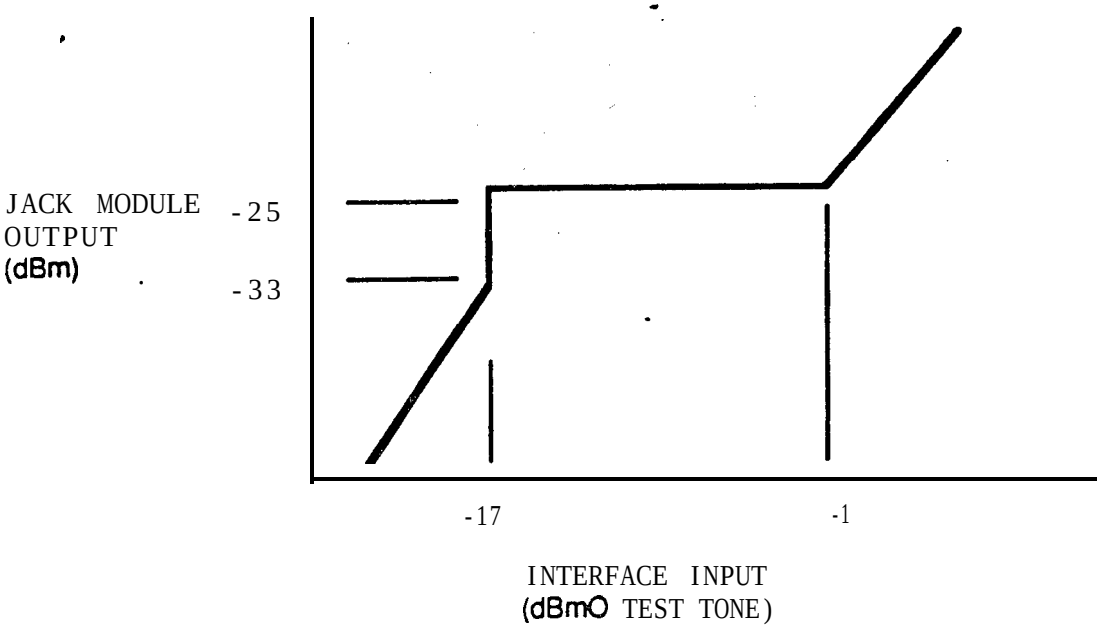


Figure 3-1B. Receive Transfer Function

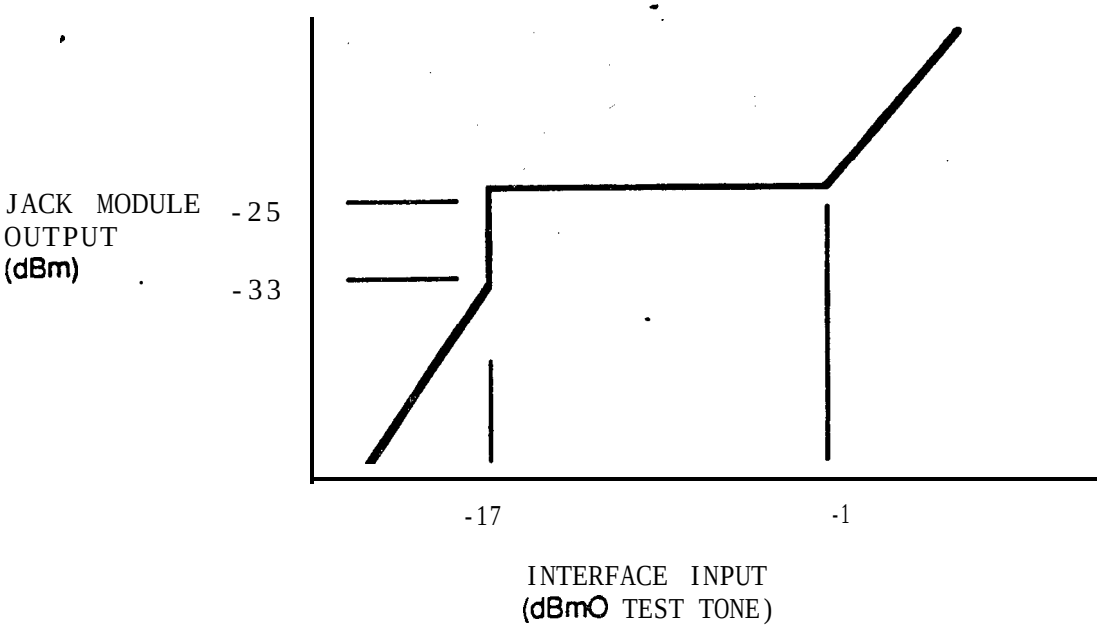


Figure 3-1B. Receive Transfer Function

which exceeds 200% of the 99.99 percentile column of Table III. All other functional failures are non-critical and shall not exceed 500% of the time specified in the 99.99 percentile column of Table III or one second, whichever is greater. The A/G availability model shall use a of twenty-four frequencies. Position-level functions shall exhibit the corresponding availabilities specified in Table IX. Non-VSCS hardware/software is not included in VSCS availability determination.

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3.2.3.2 System-level Availability - The availability of the VSCS is determined by the number of positions whose critical functions are operationally available. A system failure occurs when one or mare critical functions are unavailable in more than 10% of the positions. The system-level availability requirement is based upon the smallest sized system. All systems will exhibit an availability of no less than the system-level availability requirement in Table X. The function and equipment required to switch between the A/G primary switch and the A/G backup switch is included in the system-level availability requirement. The A/G backup switch shall not be considered in the system-level availability calculation. The A/G backup switch shall exhibit an availability of 0.9999999.

3.2.3.3 Support functions Availability - The availability requirement for support functions is defined as A(i) = 0.999 with an MTTR of one hour.

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## 3.3 OPERATIONAL REQUIREMENTS

### 3.3.1 A/G Communications

3.3.1.1 General Requirements - Each air traffic controller operating position within a facility shall be provided the capability for assignment of A/G communications functions. Assignment of an A/G communications function at a given air traffic controller position shall be controlled by configuration maps as determined by site adaptation data. A/G communications functions shall include, but not be limited to, the following:

a. Selection and deselection of the position's assigned frequencies.

b. M/S transmitter selection for each assigned frequency.

c. M/S receiver selection for each assigned frequency.

d. Selection and deselection capabilities for cross-coupling frequencies.

e. Independent enabling/disabling of transmission for each selected frequency at an operational position.

f. Independent local muting of received voice for each selected frequency at an operational position, for frequencies assigned to split-mode operations by site adaptation data.

g. Remote muting of receivers for selected frequencies.

h. Transmitter/receiver remote site selection for designated frequencies that have radio outlets at more than one remote site.

i. Enabling and disabling of automatic transfer of A/G voice from HS to LS if the operator engages in G/G voice communications.

j. Broadcast of pre-recorded weather messages.

k. Selection and assignment of BUEC.

l. Selection of UHF or VHF emergency frequencies, or both, for reception or transmission, or both.

m. PTT preemption capabilities for selected frequencies.

n. Manual selection of routing of 'incoming voice to HS or LS for each selected frequency at a position, for frequencies assigned to split-mode operations by site adaptation data.

o. PTT lockout when A/G transmission is attempted on a frequency that is in use by another position.

p. Visual indication on all assigned frequencies of the presence of squelch break on received voice or PTT confirmation on transmitted voice.

q. Confirmation of PTT, M/S selection, remote and local muting, and frequency selection.

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p. Visual indication on all assigned frequencies of the presence of squelch break on received voice or PTT confirmation on transmitted voice.

q. Confirmation of PTT, M/S selection, remote and local muting, and frequency selection.

transmit capabilities enabled and those with transmit capabilities not enabled, and between reception of squelch break on frequencies at the position with receive capabilities enabled and those with receive capabilities not enabled.

3.3.1.1.1.6 Frequency Status Display - For each air traffic controller position that has been assigned A/G communications capabilities, the VSCS shall provide access to a frequency status display which provides simultaneous visual indication of real time frequency status for all frequencies selected at that position, up to 24 frequencies. Individual frequency displays shall indicate the frequency value, site designator if multiple sites for a frequency are used, and the selected routing (HS or LS) for the frequency. Frequency status information shall include PTT confirmation, squelch break and PTT and RCE trunk lockout indication. The frequency status display shall have the capability to allow the position operator to select the transmitter site on a call-by-call basis for multiple site frequencies. All other A/G selections and functions shall be activated via the appropriate touch action(s) to the A/G display. The position operator shall have the ability to enable and disable the frequency status display.

3.3.1.1.2 M/S Transmitter Selection - Every air traffic controller position that has been assigned to have A/G communications capabilities shall have the capability to select either the main or the standby transmitter for each selected frequency at the position.

3.3.1.1.2.1 M/S Transmitter Visual Indication - The A/G display at an operational position shall have a continuously visible indication of main or standby transmitter selection status for every enabled transmitter at the operating position. Frequencies using BUEC shall not have MIS transmitter indications.

3.3.1.1.2.2 M/S Transmitter Selection Method - The assignment of main or standby transmitter for a selected frequency shall require no more than two touch actions. If one touch is used, the position operator shall apply a single touch to toggle the transmitter to change the assignment to main or standby. If two touches are used, the position operator shall apply one touch to a main/standby function touch area, and a second touch to the transmitter touch area of a selected frequency to enable selection of transmitter main or standby. M/S transmitter selection shall function only for frequencies that have been selected by the position operator and are not using BUEC.

3.3.1.1.3 M/S Receiver Selection - Every air traffic controller position that has been assigned A/G communications capabilities shall have the capability to enable either the main or the. standby receiver for each selected frequency at the position.

3.3.1.1.3.1 M/S Receiver Visual Indication - The A/G display at an operational position shall have a continuously visible indication of the main

or standby receiver selected status for every frequency selected at an air traffic controller operating position. Frequencies using BUEC shall not have MIS receiver indications.

3.3.1.1.3.2 M/S Receiver Selection Method - The assignment of main or standby receiver for a selected frequency shall require no more than two touch actions. If one touch is used, the position operator shall apply a single touch to toggle the receiver to change the assignment to main or standby. If two touches are used, the position operator shall apply one touch to a main/standby function touch area and a second touch to the receiver touch area of a selected frequency to enable selection of receiver main or standby. MIS receiver selection shall function only for frequencies that have been selected for use by the position operator and which have not been selected for BUEC.

**3.3.1.1.4** Selection Using Transceivers - The above requirements shall not preclude the use of tunable radio transceivers. For facilities with access to tunable transceivers, MIS transceiver selection shall be provided. Tuning shall be accomplished external to the VSCS. Frequency selection shall be as described in **3.3.1.1.1.**

3.3.1.1.5 Cross-coupled Frequencies - The VSCS shall provide the capability to cross-couple any two frequencies. The capability shall be provided to cross-couple at least two sets of two frequencies at each position. Cross-coupling shall be the capability to transmit the received voice of one frequency of the set over the other frequency of the set without operator intervention. Cross-coupling shall be implemented under program control as determined by site adaptation data.

3.3.1.1.5.1 Cross-coupling - Any reconfiguration of the VSCS that affects positions using cross-coupling shall automatically disable any active cross-coupling at the affected positions.

3.3.1.1.5.2 Cross-coupled Frequency Indication - The enabled or disabled cross-coupling status for assigned cross-coupled frequencies shall be continuously visible to the position operator for those frequencies selected for use by the position operator.

3.3.1.1.5.3 Cross-coupling Enabling/disabling Methods - The position operator shall be provided the capability to enable the receiver-to-transmitter path(s) for cross-coupling two designated frequencies. A receiver-to-transmitter path shall be enabled or disabled by the position operator, provided that both reception and transmission on the desired path are enabled. The capability shall be provided for the position operator to have neither, either, or both receiver-to-transmitter cross-coupled path(s) enabled at any given time.

3.3.1.1.5.4 PTT Preemption of Cross-coupling - Activation of PTT at an operational position affecting a cross-coupled transmitter shall cause

or standby receiver selected status for every frequency selected at an air traffic controller operating position. Frequencies using BUEC shall not have MIS receiver indications.

3.3.1.1.3.2 M/S Receiver Selection Method - The assignment of main or standby receiver for a selected frequency shall require no more than two touch actions. If one touch is used, the position operator shall apply a single touch to toggle the receiver to change the assignment to main or standby. If two touches are used, the position operator shall apply one touch to a main/standby function touch area and a second touch to the receiver touch area of a selected frequency to enable selection of receiver main or standby. MIS receiver selection shall function only for frequencies that have been selected for use by the position operator and which have not been selected for BUEC.

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3.3.1.1.5.4 PTT Preemption of Cross-coupling - Activation of PTT at an operational position affecting a cross-coupled transmitter shall cause

site selection for a frequency. At any other position with a transmitter enabled for the frequency, or at a position attempting to enable any transmitter for the frequency, the transmitter site selected by the classmarked position shall be displayed as enabled. The VSCS shall provide controls such that only one of the transmitters for the frequency is enabled at a time for all positions having that frequency. For operational positions using this feature, and accessing transmitter/receiver/transceiver sites via the RCE, the VSCS shall provide a voting algorithm to preclude mutual interference on received voice from the enabled receivers on the frequency. Operational positions using this feature and accessing transmitter/receiver/transceiver sites via existing radio interfaces shall manually select the receiver site for that frequency. The capability shall be provided for up to at least 6 sites per frequency at each operational position.

3.3.1.1.7.3.1 PTT Receiver Muting of Multiple Sites - When PTT is active at the interface for any site, for a frequency configured for multiple sites, the switching function shall completely mute the received radio voice at the interfaces for all sites for the frequency. This function shall also apply when one or more of the sites have been selected for BUEC.

3.3.1.1.8 Automatic Transfer of A/G Voice Routing - For operational positions with A/G communications capabilities, the VSCS shall provide for the automatic transfer of the routing of incoming A/G voice from the headset/handset to the position's A/G loudspeaker, during those periods when the position operator is engaged in G/G communications, except incoming override calls, using the position headset/handset and has also selected incoming A/G to be routed to the position headset/handset, and the receiver is enabled. The position operator shall be provided the capability to enable and disable automatic transfer of routing incoming A/G voice from the position headset(s) to the position A/G loudspeaker. If the automatic transfer of routing incoming A/G voice from the headset/handset to the position's A/G loudspeaker has been disabled and the position operator is engaged in G/G communications using the position headset/handset and has also selected incoming A/G to be routed to the positions headset/handset, the incoming A/G voice shall be heard with the G/G voice in the headset/handset. Incoming A/G voice shall be automatically routed to the position A/G loudspeaker at an inactive operational position (see 3.3.3.2, Inactive position).

3.3.1.1.8.1 Automatic Transfer of A/G Voice-routing Indication - For operating positions with A/G communications capabilities, the current selection status for automatic transfer of A/G voice routing shall be continuously visible to the position operator.

3.3.1.1.8.2 Automatic Transfer of A/G Voice-routing Selection Method - Automatic routing transfer of A/G voice shall be enabled or disabled by a single touch action by the position operator.

3.3.1.1.9 Pre-recorded Weather Messages - For each operational position that has A/G frequency assignments, the VSCS shall provide the capability

for the position operator to select any from at least four weather information recording channels, accessible from the position through the VSCS, for monitor or for monitor and broadcast. The weather-recording monitor and broadcast, when enabled, shall provide for transmission of the weather recording on all enabled transmitters at the position. The weather recording monitor, when selected, shall permit the position operator to listen to the weather recording without its transmission over any A/G circuit. Weather recording monitor shall be routed to the G/G LS or HS as determined by the position non-OVR G/G voice routing selection.

3.3.1.1.9.1 Weather Broadcast Indications - When the weather-recording feature is enabled, the position operator shall be presented with a list, on the interactive display of the weather recording designators of those recordings available to the position, and the option of only monitoring or monitoring and broadcasting the selected weather recording. Visual indication shall be provided to show the following:

a. When the weather recording access feature is enabled and when it is disabled.

b. Which weather recording is selected (when selected),

c. Failure to achieve connectivity to the weather message recorder. A visual indication and a distinct audible tone shall be provided to the position operator and the maintenance position shall be notified. The audible tone shall not be transmitted on any A/G-frequency.

d. Transmission of the selected weather recording on all selected and enabled transmitters, for the duration of the transmission.

3.3.1.1.9.2 Weather-recording Selection - Weather recording feature access shall be enabled by touch action by the position operator. The option of monitor only or of monitor and broadcast shall then be selectable by a single touch action. The desired weather recording shall then be selected by a single touch action. 'The VSCS shall, in response to the Weather recording selection, seize an available weather recorder tieline and outpulse the appropriate access code (address) corresponding to the selected weather recorder channel (for the currently active VSCS configuration) in accordance with the VSCS-WEATHER IRD. Mapping between each of the four A/G position weather selectors and one of up to 950 weather recorder channel addresses shall be under the control of the VSCS reconfiguration function specified in 3.5.4.1. When in the monitor and broadcast mode, the position operator shall have the capability to manually deselect the monitor function without disrupting the weather broadcast. The mode shall automatically change from monitor while broadcasting to broadcast only upon the initiation or answering of a Ground-to-Ground call by the position operator. When in the broadcast only mode, the position operator shall have the capability to initiate and answer G/G calls without disrupting the weather broadcast. The weather recording access feature shall be disabled if no option is selected within 14 seconds after enabling the option selection, or at any time by an A/G PTT action by the position operator or by a valid PTT preemption by another position operator. Under no circumstances shall voice associated with a G/G call be broadcast over the A/G frequency.

3.3.1.1.10 Selection and Assignment of BUEC - The VSCS shall provide access to the BUEC system from each air traffic controller position that has A/G communications capabilities enabled. BUEC selection and frequency assignment shall be accomplished through operator actions using the interactive display device(s). For any given frequency at an operational position, accessing BUEC shall inhibit using any communication control normally piovided by the RCE interface or existing radio interfaces for that frequency.

3.3.1.1.10.1 BUEC Indications - The VSCS shall provide visual indications of which frequency or frequencies, if any, have been selected for and are using the BUEC system. The position operator shall be provided with a visual display of up to 4 character BUEC mnemonic of the BUEC site selected by BUEC and in use for servicing A/G communications on each frequency selected for BUEC. The BUEC site mnemonic shall be obtained from site adaptation data and'shall be as derived from the BUEC priority-module number. The position operator and designated positions shall be provided a visual and/or audible alert indication in accordance with the VSCS-BUEC IRD, if BUEC access is requested and is for any reason not available.

3.3.1.1.10-Z BUEC Selection Method - The VSCS shall provide access to BUEC in accordance with the VSCS-BUEC IRD. A position operator shall activate the BUEC selection function with a single touch action. A visual indication shall be provided that the BUEC selection function is enabled. A subsequent touch action to a displayed frequency value at the position shall designate the frequency as selected for transfer to BUEC, and disable the BUEC selection function and its visual indication. The BUEC selection function shall be disabled if no frequency designation is made within 15 seconds after the BUEC selection function is enabled.

3.3.1.1.10.3 BUEC Deselection - The use of BUEC for a selected frequency shall be deselected by a single touch action. The M/S transmitter and M/S receiver selection status for the frequency shall revert to the current selection status in effect as determined by the VSCS A/G interface.

3.3.1.1.11 Selection of Emergency Frequencies - The VSCS shall provide every air traffic controller position that has A/G capabilities the capability to access the UHF and VHF emergency frequencies of 243.0 MHz and 121.500 MHz. The VSCS shall provide connectivity to the RCE or existing radio interfaces for the emergency frequency transmitters and receivers from all air traffic controller positions that have the emergency frequencies assigned. The position operator shall have the capability of local muting or enabling reception of voice at the position, for either or both emergency frequencies. If emergency frequencies are assigned to any operational positions within an area supervisor's area of responsibility, then that supervisor shall receive an alarm indication when any of the emergency receivers within that area are not being monitored by at least one operational position.

3.3.1.1.11.1 Emergency Frequency Indications - Emergency frequencies and emergency frequency control areas shall be uniquely marked on operational position interactive displays.

3.3.1.1.11.2 Emergency Transmitter Activation - Transmission on either emergency frequency or both of the emergency frequencies simultaneously shall require a single, continuous, nonlatching touch action by the position operator on the desired emergency frequency select area. Voice from the position shall be transmitted over the selected emergency frequency (frequencies) and over all other frequencies at the position that are selected and have transmitters enabled, for the duration of the operator touch. A visual indication shall be provided to every position operator with emergency frequency assignments to notify of the activation of an emergency frequency transmitter.

3.3.1.1.11.3 Emergency Transmitter Lockout - Activation of a transmitter for either emergency frequency at an operational position shall lock out use of that transmitter at all other operational positions for the duration of the transmission. The position operator at a locked-out position shall be provided visual and audible indications that the emergency frequency access has been locked out, if PTT is attempted on the emergency frequency.

3.3.1.1.12 PTT - All voice transmission of A/G communications, except emergency frequency communications, at an air traffic controller position shall be activated by either a hand-activated PTT device or a foot-activated PTT device at the discretion of the position operator. Activation of A/G voice transmission shall not be precluded, nor be affected by the use of nonlatching DA selectors for G/G communications. In this case, the VSCS shall provide for simultaneous A/G and G/G communications emanating from a position.

3.3.1.1.12.1 PTT Lockout - Except cases where PTT preemption is permitted by classmark, an attempt by a position operator to transmit on a frequency currently being used for transmission (PTT active) by another position operator shall cause a PTT lockout of that frequency at the attempting position. The position operator at the attempting position shall be provided a visual and an audible indication that the transmission on the frequency has been locked out. The PTT lockout audible indication shall be distinct from any other audible indications, and shall be supplied for the duration of the PTT lockout on that frequency. PTT shall not be locked out on other frequencies selected for transmission at the positions that are not currently being used for transmission by other position operators.

3.3.1.1.12.2 PTT Preemption - Every frequency assigned to an air traffic controller position shall be classmarked as either possessing or lacking PTT preemption relative to that position's use of the frequency. A PTT action by the position operator activating transmission on a frequency designated as preempting shall cause the termination of any transmission in progress on that frequency at any other air traffic controller position. The position operator at a position whose transmission has been preempted shall receive distinct visual and audible indications that preemption has occurred, and

3.3.1.1.11.1 Emergency Frequency Indications - Emergency frequencies and emergency frequency control areas shall be uniquely marked on operational position interactive displays.

3.3.1.1.11.2 Emergency Transmitter Activation - Transmission on either emergency frequency or both of the emergency frequencies simultaneously shall require a single, continuous, nonlatching touch action by the position operator on the desired emergency frequency select area. Voice from the position shall be transmitted over the selected emergency frequency (frequencies) and over all other frequencies at the position that are selected and have transmitters enabled, for the duration of the operator touch. A visual indication shall be provided to every position operator with emergency frequency assignments to notify of the activation of an emergency frequency transmitter.

3.3.1.1.11.3 Emergency Transmitter Lockout - Activation of a transmitter for either emergency frequency at an operational position shall lock out use of that transmitter at all other operational positions for the duration of the transmission. The position operator at a locked-out position shall be provided visual and audible indications that the emergency frequency access has been locked out, if PTT is attempted on the emergency frequency.

3.3.1.1.12 PTT - All voice transmission of A/G communications, except emergency frequency communications, at an air traffic controller position shall be activated by either a hand-activated PTT device or a foot-activated PTT device at the discretion of the position operator. Activation of A/G voice transmission shall not be precluded, nor be affected by the use of nonlatching DA selectors for G/G communications. In this case, the VSCS shall provide for simultaneous A/G and G/G communications emanating from a position.

3.3.1.1.12-1 PTT Lockout - Except cases where PTT preemption is permitted by classmark, an attempt by a position operator to transmit on a frequency currently being used for transmission (PTT active) by another position operator shall cause a PTT lockout of that frequency at the attempting position. The position operator at the attempting position shall be provided a visual and an audible indication that the transmission on the frequency has been locked out. The PTT lockout audible indication shall be distinct from any other audible indications, and shall be supplied for the duration of the PTT lockout on that frequency. PTT shall not be locked out on other frequencies selected for transmission at the positions that are not currently being used for transmission by other position operators.

3.3.1.1.12.2 PTT Preemption - Every frequency assigned to an air traffic controller position shall be classmarked as either possessing or lacking PTT preemption relative to that position's use of the frequency. A PTT action by the position operator activating transmission on a frequency designated as preempting shall cause the termination of any transmission in progress on that frequency at any other air traffic controller position. The position operator at a position whose transmission has been preempted shall receive distinct visual and audible indications that preemption has occurred, and

8. Routing of incoming G/G calls to HS or G/G LS.
9. Routing of incoming G/G OVR calls to HS or G/G LS.
10. Recording of position relief briefings.
11. Position voice monitoring.
12. PTT for G/G communications.
13. Manual ring assignment.

Requirements for the G/G communications listed above are detailed in the following paragraphs.

3.3.2.1.1 Intercom/Interphone - The VSCS shall provide each operational position the IC/IP communications. Access to each of these shall be determined by configuration database map(s) for the positions. Call mode and call feature restrictions shall be controlled by classmarks assigned by authorized personnel and resident in the position maps.

3.3.2.1.2 Routing of Incoming G/G Voice - The VSCS interactive display shall provide separate HS/LS routing selectors for incoming OVR calls and for incoming non-OVR calls. Incoming voice call routing, however, shall be in accordance with 3.3.2.2.9 and 3.5.2.2.2.6.2.

3.3.2.1.2.1 Selection of G/G Voice Routing - The position operator shall be able to select the routinq of the incoming OVR voice communications path with a single touch action. -The position operator shall be able to select the routing of all other incoming G/G voice communications with a single touch action. Successive touch actions for either selection shall toggle the routing between the G/G LS at the position and the HS(s) at the position.

3.3.2.1.2.2 Indication of Voice Routing - The position operator shall be provided with continuous visual indication of the current selected G/G incoming voice communications path routing to either the G/G LS or the HS(s) at the position for both incoming OVR communications and "all other" incoming G/G communications.

3.3.2.1.2.3 Incoming G/G Call Indication - All incoming G/G calls requiring an operator touch action to answer the call shall be indicated by a distinct visual indication at the appropriate touch response area/call designator and, except voice calls, by sounding the chime at the called position, if it has been enabled by the position operator. For incoming IP calls, on trunk types that do not have supervisory signaling, a call that is not answered within a suitable timeout period shall be automatically disconnected.

3.3.2.1.2.4 Position Relief Briefing Recording - The VSCS shall provide for the recording of position relief briefings between the operator going off duty at a position and the operator assuming duties at that position. While the position relief briefing recording function is active, all conversation between the two operators plus all A/G and G/G communications at the position shall be recorded in accordance with the VSCS-REC IRD (see 3.6.9).

3.3.2.1.2.4.1 Position Relief Briefing Recording Activation - The prerequisite for activation of position relief briefing recording at a position shallbe headsets plugged into both position jacks. The position relief briefing recording shall then be activated by a single touch action by the position operator. The HS microphones shall be set to an "open mike" condition. A continuous visual indicationshall be provided for the duration of the position relief briefing. Position relief briefing recording shall. be deactivated by a single touch action by the position operator or by the removal of either of the headsets from the position jack module.

3.3.2.1.2.5 Position Voice Monitoring - The VSCS shall provide the capability for any operational position to concurrently monitor, up to 9 position, all voice communications directed to and emanating from any other position(s) within a facility. Access to position voice monitoring at designated positions shall be defined and restricted by classmarks assigned by authorized supervisory personnel and resident in the configuration database map(s) for the position.

3.3.2.1.2.5.1 Position Voice-monitoring Restrictions - Position voice monitoring of any operational position by any other operational position shall in no way alter or degrade A/G or G/G communications at the monitored position. The operational position being monitored shall receive no visual, audible, or other indication that the position is being monitored.

3.3.2.1.2.5.2 Position Voice-monitoring Access - Access to position voice monitoring at an air traffic controller position shall be provided by DA or IA. DA position voice monitoring shall be provided by a single touch action to an appropriately marked and classmarked DA designator. IA position voice monitoring shall be provided, position classmark permitting, by entering the position voice-monitoring function code, then entering the number of the position to be monitored. Position voice monitoring shall be suspended if the monitoring position initiates any G/G communication or receives an OVR call, or answers any other G/G communications. Position voice monitoring, if selected, shall be resumed when no other G/G communications are extant. Position voice monitoring shall be terminated by individually terminating each active voice-monitoring selection. While the position voice-monitoring function is active, the position operator at the monitoring position shall be provided a continuous visual indication that position voice monitoring is in progress, along with the designation of the position being monitored.

3.3.2.1.2.6 PTT for G/G Communications - All voice transmission of G/G communications at an operational position using latching DA activators shall be enabled only by either a hand-activated or foot-activated PTT device. For G/G calls requiring PTT, no voice or other signal shall be transmitted from the position over G/G unless PTT is activated at the position.

3.3.2.1.2.6.1 PTT for G/G DA - DA call activations that require PTT shall emulate a latching pushbutton. A single touch action shall activate the call, a PTT activation shall be required to transmit voice on the circuit, and call release shall be effected as described in 3.3.2.2.2. For the time interval that the G/G PTT feature is enabled at a position with A/G communications enabled, PTT shall not cause transmission of voice on any

frequencies selected at that position. Release of the G/G call shall reenable the PTT feature for A/G communications.

3.3.2.1.2.7 ATIS Monitoring - Capabilities for monitoring Automated Terminal Information Service (ATIS) recordings shall be provided to designated VSCS operational positions. Access to ATIS recordings shall be by DA, IA, or both. Position access to ATIS shall be designated by classmark in the position map(s) of the configuration database.

3.3.2.2 IC/IP - The VSCS shall provide IC to permit any operational position within a facility to establish voice communications with any other position within that facility. The VSCS shall provide IP to permit any operational position within a facility to establish voice communications to any position at another facility. Access to IC and IP communications at an operational position shall be through DA or IA, or both.

3.3.2.2.1 Active IC/IP Calls - A position active call is an IC/IP call that a position operator can release by a single touch action at the position. Monitoring, incoming OVR calls, and calls in a HOLD status are not, by this definition, position active calls. An operational position shall be permitted to engage in only one position active call at a time. Initiation of an IC/IP call by DA or IA shall cause the release of any position active calls in progress at the position.

3.3.2.2.2 Call Disconnection - Position active calls shall be disconnected by any operator release method defined in the following paragraphs.

3.3.2.2.2.1 Call Release Designator - Position active calls shall be disconnected by a single touch action of the call release designator.

3.3.2.2.2.2 DA Call Designator Release - Position active calls shall be disconnected by a single touch action to the active DA call designator or to the active call designator in the incoming CA queue area.

3.3.2.2.2.3 Release by Initiating a Call - Position active calls shall be disconnected by the initiation of another DA or IA call at the position.

3.3.2.2.2.4 Release by Answering a Call - Position active calls shall be disconnected by any touch action required to answer an incoming call at the position.

3.3.2.2.2.5 Release by Resuming a Call - Position active calls shall be disconnected by any touch action that resumes a call that had previously been placed on HOLD.

3.3.2.2.2.6 Release Indications - Indication of call release shall be

frequencies selected at that position. Release of the G/G call shall reenable the PTT feature for A/G communications.

3.3.2.1.2.7 ATIS Monitoring - Capabilities for monitoring Automated Terminal Information Service (ATIS) recordings shall be provided to designated VSCS operational positions. Access to ATIS recordings shall be by DA, IA, or both. Position access to ATIS shall be designated by classmark in the position map(s) of the configuration database.

3.3.2.2 IC/IP - The VSCS shall provide IC to permit any operational position within a facility to establish voice communications with any other position within that facility. The VSCS shall provide IP to permit any operational position within a facility to establish voice communications to any position at another facility. Access to IC and IP communications at an operational position shall be through DA or IA, or both.

3.3.2.2.1 Active IC/IP Calls - A position active call is an IC/IP call that a position operator can release by a single touch action at the position. Monitoring, incoming OVR calls, and calls in a HOLD status are not, by this definition, position active calls. An operational position shall be permitted to engage in only one position active call at a time. Initiation of an IC/IP call by DA or IA shall cause the release of any position active calls in progress at the position.

3.3.2.2.2 Call Disconnection - Position active calls shall be disconnected by any operator release method defined in the following paragraphs.

3.3.2.2.2.1 Call Release Designator - Position active calls shall be disconnected by a single touch action of the call release designator.

3.3.2.2.2.2 DA Call Designator Release - Position active calls shall be disconnected by a single touch action to the active DA call designator or to the active call designator in the incoming CA queue area.

3.3.2.2.2.3 Release by Initiating a Call - Position active calls shall be disconnected by the initiation of another DA or IA call at the position.

3.3.2.2.2.4 Release by Answering a Call - Position active calls shall be disconnected by any touch action required to answer an incoming call at the position.

3.3.2.2.2.5 Release by Resuming a Call - Position active calls shall be disconnected by any touch action that resumes a call that had previously been placed on HOLD.

3.3.2.2.2.6 Release Indications - Indication of call release shall be

touch activations. DA selectors shall be distinctly marked to indicate their OVR capability.

3.3.2.2.3.3.2 Nonlatching DA OVR Call Initiation - DA OVR calls classmarked to require nonlatching touch activations shall be initiated by the touch action and released by cessation of the touch action; the position microphone of the position headset/handset shall be active for the duration of the touch action. .

3.3.2.2.3.4 OVR Call Answering - No touch actions or PTT activations shall be required of a position operator to answer any incoming OVR call.

3.3.2.2.3.5 OVR Call Indications - The VSCS shall provide an audible zip tone (0.2 second burst of dial tone) and a visual indication of an incoming OVR call at an operational position. A visual indication and an audible modified zip tone distinct from those for the first incoming OVR call shall be provided to the position operator at the called position for any additional incoming OVR calls. The VSCS caller ID(s) of the overriding caller(s) shall be displayed at the called position for the duration of the OVR call(s), to the extent of space available on the interactive display.

3.3.2.2.4 IA - Both IC and IP circuits shall be accessible via IA. IA requires using the IA keypad to initiate a call or a control function.

3.3.2.2.4.1 IA Call Initiation - Any IA call from a position shall be initiated by activating the IA keypad, then entering the number sequence for the desired call destination.

3.3.2.2.4.1.1 IA Access Keypad Enable - The IA keypad device shall be enabled for input by activation of an IA or equivalently marked key. Enabling the IA keypad shall clear any previous entries and status messages that may be present on the keypad alphanumeric display, and shall cause a reset for any number sequences that may have been entered prior to re-enabling.

3.3.2.2.4.2 IA Call Timeout - The IA keypad shall be disabled for acceptance of input if 15 seconds have elapsed since activation of the IA keypad or since the last digit was entered, whichever is later, prior to a complete dialing sequence being entered, or upon completion of a dialing sequence. When the destination, identified by the number sequence, is an IP circuit'that requires additional dialing, the IA Keypad shall be re-enabled. The timeout. and automatic disable features shall not apply when connected to an IP circuit.

3.3.2.2.4.3 IA OVR Calls - The VSCS shall provide for the capability of initiating OVR calls using IA from any operational position. The voice of the overriding party shall not be transmitted over any A/G communications in progress at the overridden position. IA OVR shall be initiated by entering an OVR function code, or equivalent, preceding the dialing sequence. Answering of OVR calls initiated by IA shall be as described for answering

I OVR calls.

3.3.2.2.4.4 CA Queue - An Incoming call (ID or DA) to an operational position that does not have a corresponding DA touch area for answering the call (whet-5 answering is required) shall be directed to the called position's CA queue; otherwise, the capability for answerinq the call shall I be provided at-the appropriate DA selector.

3.3.2.2.4.4.1 Caller Identification (ID) - The VSCS position designator of the call source shall be displayed on the G/G communications CA queue display area of the called position. Where call source information is not available, the line/trunk designator for that incoming call shall be displayed on the CA queue area. Caller IDs displayed in the CA queue area shall not be shifted from one displayed queue position to another as a result of any changes in the number of calls in the queue. The CA queue area shall be capable of displaying at least 12 alphanumeric characters in each queue position.

3.3.2.2.4.4.2 CA Queue Depth - Provision shall be made to accommodate up to four calls in the position CA queue, including an active CA queue call and queue calls on HOLD. When the answer queue is full, incoming calls that would normally be directed to the position CA queue shall not be connected, and a busy indication shall be sent to the calling party.

3.3.2.2.4.4.3 Common Answer Queue Selection - The position operator shall have the capability to select any call in the answer queue in any order for answering, and to cause the automatic selection of the pending call that has been in the CA queue for the longest time.

3.3.2.2.5 Call HOLD - The VSCS shall provide the capability for a position I operator to place any non OVR position active call, including participating I in conference calls, in a HOLD status with a single touch of the HOLD area. I The position operator shall be provided a continuous visual indication of I the call indicator at the operational position that a call is in a HOLD I status for the duration of time that a call is on HOLD. A CA queue call placed on HOLD shall retain its position in the CA queue. An IA call placed I on HOLD shall be moved to the CA queue providing that a CA queue space is currently unused; otherwise, hold shall be denied, and appropriate I notification shall be given to the position operator.

3.3.2.2.5.1 Resuming Call on HOLD - The position operator shall be provided the capability to resume a call on HOLD by a single touch action to the call designator for the desired call. Resumption of a call on HOLD shall cause the disconnection of any position active calls that may be in progress. Automatic call answer queue selection shall not affect CA queue calls on HOLD.

3.3.2.2.6 Call Forwarding - The VSCS shall provide the capability of any position operator to enable the call forwarding feature for that operational position. All G/G calls directed to a position with the call forwarding feature enabled shall be redirected to a designated destination position within the facility. Call forwarding shall not affect the continued use of any A/G functions at the operational position. Call for-

warding shall "be restricted to forwarding to operational positions within the same facility. A position having once initiated call forwarding shall automatically be released by the VSCS from receiving subsequent G/G calls.

3.3.2.2.6.1 Enabling Call Forwarding - A position operator shall be provided the capability to enable call forwarding at an operational position. The forwarding destination shall be designated by a single touch action to a DA designator for the destination position, or by entering the destination position number on the IA keypad.

3.3.2.2.6.2 Disabling Call Forwarding - A position operator shall be provided the capability of disabling the call forwarding function at an operational position by using an IA code. Additionally, if no forwarding destination is designated within 10 seconds after enabling of the call forwarding function at an operational position, or if any other G/G function is selected, then the call forwarding function shall be disabled. Call forwarding discontinuance shall be controlled by the initiating position or by the supervisory or maintenance positions classmarked for that capability.

3.3.2.2.6.3 Call Forwarding Indications - For the duration of time that call forwarding is in effect at an operational position, a message shall be provided on the G/G display at the position indicating that call forwarding is in effect with the designator of the destination position. The cognizant area supervisor shall be provided an indication when an operational position has enabled call forwarding, and when that position subsequently disables call forwarding.

3.3.2.2.6.4 Call Forwarding Closure - The VSCS shall provide internal controls to prevent closure of call forwarding. Position-to-position call forwarding shall not be permitted to form a closed forwarding loop. An operational position shall not be permitted to be the ultimate recipient of its own call forwarding. The position operator at the operational position attempting to enable call forwarding that would cause closure shall be provided a notice that forwarding to the designated position is not allowed due to forwarding closure.

3.3.2.2.7 Call Transfer - The VSCS shall provide the position operator at an operational position the capability to transfer any position active calls to any other operational position within a facility, with the exception of override calls. When the call transfer has been enabled and a transfer destination has been designated, the position active call shall be disconnected at the transferred-from position and reconnected at the transferred-to position. Call transfer shall be restricted to transfer of calls to active operational positions within the same facility. The transferred call shall become subject to the availability of connection at the transferred-to position.

3.3.2.2.7.1 Enabling Call Transfer - A position operator shall be provided the capability to enable call transfer at an operational position. Enabling of the call transfer function shall cause the enabling of the IA keypad. The

call transfer destination within the facility shall be designated by a single touch action to a DA designator for the destination position or by entering the destination position number on the IA keypad. The position operator shall not be required to monitor or otherwise control the call after the transferee has-been designated.

3.3.2.2.7.2 Disabling Call Transfer - A position operator shall be provided the capability of disabling the call transfer function at an operational position by a second touch action to the transfer function indicator or by entering an IA function code. If no transferee is designated within 10 seconds after enabling of the call transfer function at an operational position, if the call is released, or if any other G/G function is selected, then the call transfer function shall be disabled. The call shall remain active after the timeout condition. The IA keypad shall be disabled for input, except where the position operator has selected a new G/G function that would otherwise enable and reset the IA keypad.

3.3.2.2.7.3 Call Transfer Indications - The position operator shall be provided a continuous visual indication that the transfer function is enabled for the duration of time that the function is enabled at the operational position. The position operator shall be provided an alert if the designated transferee position is not operational, and the transfer function shall be disabled at the transferring position.

3.3.2.2.8 Conference Calls - The VSCS shall provide the capability for any position operator to initiate and participate in conference calls, up to the limits given in 3.5.2.2.2.5, Conferencing. Three types of conference capabilities shall be provided: progressive conferencing, meet-me conferencing, and preset conferencing. Access to conferencing capabilities at an operational position shall be defined and limited by classmarks in the position map(s) for the position. IA and DA access 'to conference calls shall be provided. A visual indication of participation in a conference call shall be provided to each position operator while active in a conference.

3.3.2.2.8.1 Progressive Conferencing - The VSCS shall provide the capability for authorized operational positions to initiate progressive conferences by a single touch action or by entering an appropriate IA function code sequence, or both. All non-OVR IA and non-OVR DA calls initiated at the operational position where the conference function is enabled, and answered by the called positions, up to the conference limit of the VSCS or of the position, whichever is less, shall become pat-ticipants in the conference call.

3.3.2.2.8.2 Meet-me Conferencing - The VSCS shall provide the capability for operational positions to participate in meet-me conferences by a single touch action or by entering an appropriate IA function code sequence, or both. A conference bridge, or equivalent, with the feature that any operational position, up to the conference limit of the.VSCS, accessing the bridge becomes party to any conference on the bridge, shall be provided.

call transfer destination within the facility shall be designated by a single touch action to a DA designator for the destination position or by entering the destination position number on the IA keypad. The position operator shall not be required to monitor or otherwise control the call after the transferee has-been designated.

3.3.2.2.7.2 Disabling Call Transfer - A position operator shall be provided the capability of disabling the call transfer function at an operational position by a second touch action to the transfer function indicator or by entering an IA function code. If no transferee is designated within 10 seconds after enabling of the call transfer function at an operational position, if the call is released, or if any other G/G function is selected, then the call transfer function shall be disabled. The call shall remain active after the timeout condition. The IA keypad shall be disabled for input, except where the position operator has selected a new G/G function that would otherwise enable and reset the IA keypad.

3.3.2.2.7.3 Call Transfer Indications - The position operator shall be provided a continuous visual indication that the transfer function is enabled for the duration of time that the function is enabled at the operational position. The position operator shall be provided an alert if the designated transferee position is not operational, and the transfer function shall be disabled at the transferring position.

3.3.2.2.8 Conference Calls - The VSCS shall provide the capability for any position operator to initiate and participate in conference calls, up to the limits given in 3.5.2.2.2.5, Conferencing. Three types of conference capabilities shall be provided: progressive conferencing, meet-me conferencing, and preset conferencing. Access to conferencing capabilities at an operational position shall be defined and limited by classmarks in the position map(s) for the position. IA and DA access 'to conference calls shall be provided. A visual indication of participation in a conference call shall be provided to each position operator while active in a conference.

3.3.2.2.8.1 Progressive Conferencing - The VSCS shall provide the capability for authorized operational positions to initiate progressive conferences by a single touch action or by entering an appropriate IA function code sequence, or both. All non-OVR IA and non-OVR DA calls initiated at the operational position where the conference function is enabled, and answered by the called positions, up to the conference limit of the VSCS or of the position, whichever is less, shall become pat-ticipants in the conference call.

3.3.2.2.8.2 Meet-me Conferencing - The VSCS shall provide the capability for operational positions to participate in meet-me conferences by a single touch action or by entering an appropriate IA function code sequence, or both. A conference bridge, or equivalent, with the feature that any operational position, up to the conference limit of the.VSCS, accessing the bridge becomes party to any conference on the bridge, shall be provided.

initiator with access to the voice trunk for the duration of time that the trunk is in use. When a voice call is answered, the voice path for the voice call at an answering position shall be directed to the selected G/G incoming voice path routing at that position, and removed from the G/G loudspeakers at all positions on the voice call circuit. Any position operator on the voice call circuit shall have the capability to join the voice call in progress, while the voice call circuit is active, by a DA touch action.

3.3.2.2.9.2 Release from Voice Calls - Each active participant in the voice call, except the last participant, shall be required to release from the voice call by any of the defined disconnect methods. For inter-VSCS voice calls, the VSCS shall provide disconnection.of the last participant when either of the last two parties on the call performs any of the release actions specified in 3.3.2.2.2, Call disconnection.

3.3.2.2.9.3 Voice Call Indications - The VSCS shall provide a visual indication to all called parties on a voice call circuit until at least' one party answers the call. Every position that answers the voice call shall be provided a distinct visual indication of participation in the voice call for the duration of time that the position is participating in the voice call. After any position on the voice call circuit answers the call, then all other operational positions on the voice call circuit that have not answered (or have answered and released) the voice call shall be provided a distinct visual indication (STEADY) of the continued use of the voice call circuit for the duration of time that the circuit is still active.

3.3.2.2.10 Manual Ring Circuits - For those calls initiated at an operational position on lines requiring manual ring, the VSCS shall provide the capability for the calling position operator to invoke the manual ring by a nonlatching touch action. The manual ring feature shall be available at all times during the interval between initiation of a manual ring call and the call being released by the calling party.

3.3.2.2.11 IA Special Functions - For functions at an operational position for which it is not practical nor desirable to maintain continuous direct operator accessibility to the function, the VSCS shall provide IA entry sequences to effect the desired functions in accordance with the VSCS numbering plan. The use of IA special functions at an operational position shall not affect any A/G or G/G communications that may be in progress at the I position. IA special functions are not available while an IA-initiated G/G call is active at a position.

3.3.2.2.11.1 Display Interchange - For interactive display designs using two displays with identical technologies, the VSCS shall provide an IA special function to enable the position operator at an operational position to cause the interactive display features on either display to be exchanged with those on the other display.

3.3.2.2.12 VSCS Numbering Plan - A comprehensive numbering plan for the VSCS shall include the following features:

a. Access to all operational positions at any facility.

b. Minimum-length number sequence adequate for proposed facility sizing.

c. Abbreviated "dialing" for frequently used PSTN, FTS, and inter-facility calls.

d. Access to IA control functions.

e. Access to functions specified under requirements for supervisory positions.

f. Following a logical plan that will lend itself to ease of use. For example, the dial code for a position could include the ATC sector number as part of that code.

g. Compatibility with numbering plans of switching systems that interface with the VSCS (e.g., ICSS, WECO 3001301, etc.). Number aliases, translation, or other methods are acceptable in meeting this requirement.

3.3.3 Other Operational Requirements

3.3.3.1 Control of Multiple Positions - The capability shall be provided to configure a VSCS multiple-position sector such that a position operator at an active position within the sector can access and control all A/G and G/G communications of the multiple positions from the one designated active position. All interactive displays for the sector shall be active and accessible to the one position operator. All voice paths in such a configuration shall be routed to the one controlling active position that has headset/handset plugged into the position jack.

3.3.3.2 Inactive Position - An operational position within a given configuration shall be considered inactive for input when no voice input devices (i.e., headset or handset) are plugged into the VSCS jack module. Where no conflict exists with the control of multiple-position requirements, the interactive display, the IA keypad, PTT switches, and all other VSCS input devices shall be functionally inoperative at an inactive operational position.

3.3.3.3 Selective Signalling Trunk Circuits - The VSCS shall provide the capability for G/G IP access, for any trunk that utilizes selective signalling, to at least 5 operational positions. Any position operator on such a selective signalling trunk circuit shall have the capability to join a call in progress on the selective signalling trunk circuit, while the selective signalling trunk circuit is active, by a DA touch action or IA dial sequence.

3.3.3.4 Trunk-In-Use-Indications - For any IP trunk circuit accessible by more than one operational position, the VSCS shall provide a continuous

visual indication of circuit-in-use to the other operational position(s) having access to that circuit for the duration of the call. The trunk-in-use indicator shall be provided for all trunks for which the trunk interface supports this capability.

3.3.3.5 Trunk Selection - At the initiation of a G/G IP call, the VSCS shall have the capability to automatically select an available trunk from a group of trunks. This capability shall not eliminate the use of dedicated IP trunks.

3.3.4 Ancillary Position Operations

In addition to the ATC communications, the VSCS shall provide communications connectivity to the ancillary (user) positions provided in 3.4.4, Ancillary positions.

visual indication of circuit-in-use to the other operational position(s) having access to that circuit for the duration of the call. The trunk-in-use indicator shall be provided for all trunks for which the trunk interface supports this capability.

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3.3.4 Ancillary Position Operations

In addition to the ATC communications, the VSCS shall provide communications connectivity to the ancillary (user) positions provided in 3.4.4, Ancillary positions.

device shall meet all specifications over the entire usable interactive entry/display surface.

3.4.2.3.1-l TED Physical Requirements - The TED mounting shall prevent parallax between the touch detection plane and the display device screen when viewed from a normal operator's position. The TED shall have a nonglare, nonabradable touch surface that allows a minimum 60% light transmission. The touch surface shall be impervious and scratch-resistant to fingernails, pens, pencils, or any other object that may be used for touch activation. The touch entry surface shall permit cleaning with, and not be affected by, commercially available cleaning compounds.

3.4.2.3.1.2 TED Touch Detection - The TED shall be capable of responding to both momentary and continuous touch by a finger or inert pointer with an activating cylinder of from 0.25 inches to 1.0 inches in diameter. The assumed touch point shall be within 1/16" of the centroid of the touched area. Momentary touch shall provide latching pushbutton equivalency, and continuous touch shall provide nonlatching pushbutton equivalency. The TED shall be capable of detecting touch actions as specified for the events in Table III. The TED or its associated software shall provide detection of multiple touch and touch location movement. Simultaneous inputs to the TED shall result in an error indication. The VSCS shall provide visual feedback to verify number and function sequences input by the operator.

3.4.2.3.1.3 Immunity - The TED shall be immune to (i.e., its functionality not disturbed by):

a. Optical noise from fluorescent lighting, incandescent lighting, and display light output.

b. Electrical noise, transients, and radio frequency interference from the display, fluorescent lamps, other VSCS console and S/S equipment, or any other source.

c. Audible noise and vibrations from loud voices and equipment.

d. Sudden changes in temperature, humidity, or pressure within the control room area, including a force of air directed across the surface.

e. Smoke from any source.

f. Drifting of any display device relative to a collocated TED overlaying it.

g. Perspiration or corrosive moisture.

3.4.2.3.2 Communications Entry/Display Devices - The VSCS communications interactive entry/display devices shall be provided at all ATC positions within the sector suites, supervisory positions with access to VSCS A/G and G/G communications; and at administrative and ancillary positions with access to VSCS G/G communications.

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light conditions in the control room areas.

3.4.2.3.3.3 Installation - The IA keypad device shall be connected to a VSCS position via a twist-lock plug on a nonfouling connector cable having a minimum length of 24 inches. The IA keypad device shall have maximum dimensions of 3 inches wide by 5.5 inches deep by 2.25 inches high. The alphanumeric display shall provide at least one row of at least 20 characters, or at least two rows of at least 14 characters each, and shall be an integral part of the IA keypad. The IA keypad device shall be designed such that it may be temporarily fixed in place at the position operator's discretion.

3.4.2.3.3.4 IA Keypad Construction - The IA keypad device shall be constructed to meet the environmental requirements as specified in 3.9.5 and the shock and vibration requirements as specified in 3.9.5.2.

3.4.2.3.4 Data Entry Devices - Data entry devices for supervisory, maintenance, and designated positions shall be a cathode-ray-tube/keyboard combination or equivalent. A cursor shall be provided on the display device to indicate the character space the next entry will affect. The data entry devices shall be capable of entering and displaying alphanumeric data for configuration map manipulations, status requests, and satisfying the data entry requirements of 3.5.4, System management functions.

3.4.2.3.4.1 Operator Review - Operator review of input data prior to entering the data into the system shall be provided.

3.4.2.3.4.2 Keyboard Configurations - Keyboard configurations, where used, shall conform to MIL-STD-1280.

3.4.2.3.5 Display Refresh - For display technologies requiring display area refresh, all VSCS displays shall be refreshed at a rate not less than 60 Hz. The maximum display load shall be displayed and refreshed without any decrease in brightness, and without any flicker. Automatic voltage or current controls, or both, shall be provided to maintain the size of the displayed area within 1% of its nominal size for all normal VSCS operating conditions. The display nominal size shall be defined in the human factors study and approved by the FAA.

3.4.2.3.6 Display Brightness - The brightness of any VSCS interactive displays device shall be adjustable from 1% to 100% of full brightness,with a minimum of 20 discrete steps, where the brightness ratio between any two adjacent steps is a constant, or continuously along an exponential curve connecting such discrete points. The brightness control shall provide the capability for adjusting the display brightness over the full controllable range within 10 seconds by a single continuous touch action. This requirement shall not preclude the use of differing brightness or intensity levels within a display to convey status or other information. All VSCS displays shall have a contrast ratio of 8:1 or greater.

3.4.2.3.7 feedback to Operators - The VSCS shall provide positive feedback to all operator actions as specified in Table III. Where visual or audible indications are not otherwise specified, the operator shall be provided messages, color changes, shape changes, brightness or intensity level changes, or other distinct indications confirming a requested system action, or indications that the action was not performed. If a TED is used, then the VSCS shall provide visual feedback to the position operator of valid touch detection, and of the displayed control area affected. No feedback shall be provided for touches to displayed areas where no VSCS function or feature is invoked. If a TED is used then an operator-selectable (on/off) keyclick, indicating valid touch, shall be provided to the position operator's HS. Keyclick provided at a position shall not be transmitted over any A/G or G/G communications emanating from the position.

3.4.2.3.7.1 Function Timeouts - Where timeouts have been required in this specification, and for any other interactive operational sequences requiring two or more touch actions by a position operator to complete, then a timeout process shall be invoked after a system-level programmable time interval appropriate to the operational sequence (not greater than 30 seconds), if the operational sequence is not completed. The position operator shall be notified that such a timeout has occurred. In general, the timeout process shall effect a cancellation of the operational sequence.

3.4.2.3.8 Operator Equipment

3.4.2.3.8-1 Headsets/Handsets and PTT Switches - Headsets/handsets and hand-held PTT switches shall be plug-compatible with existing ARTCC equipment, subject to FAA approval, and consistent with the Human Factors Design Requirements.

3.4.2.3.8.2 Loudspeakers - Each console position shall be provided two identical loudspeakers. These loudspeakers shall be as approved by the FAA. One LS shall be designated for A/G communications, the other for G/G communications. The loudspeakers shall be located a sufficient distance apart so that the source of audio from each is distinguishable to the operator.

3.4.2.3.8.2.1 LS Volume Control - Volume control shall be provided for each loudspeaker. The volume control shall be located on or immediately adjacent to each LS. The volume control shall be as approved by the FAA.

3.4.2.3.8.3 Foot Switch - A foot activated switch shall be provided to perform the PTT function. The footswitch shall provide a SPST momentary contact.

3.4.2.3.8.4 Speech Intelligibility - Speech intelligibility of the VSCS shall meet the ANSI standard method of phonetically balanced monosyllabic word intelligibility, S3.2-1960, with a minimum score of 90%.

### 3.4.3 Special Entry/Display Controls

The VSCS entry/display function shall provide the air traffic controller position with special control capabilities to assist in managing the position communications. Special controls shall include, but not be limited to, the following.

3.4.3.1 RESERVED

3.4.3.2 Display Selection - Where two entry/display devices using identical technologies are provided at a common console, the entry/display function shall provide the position operator the capability to selectively alternate the two communications displays and functions between the two devices. The alternate selection shall be activated by entering an IA control code. Activation of the alternate display command shall cause the entry/display interactive control functions and images on one device to interchange with those on the other.

### 3.4.4 Ancillary Positions

The VSCS shall be capable of accommodating A/G and G/G communications at ancillary positions.

a. Area Manager.
b. Traffic Management Unit.
c. Weather Coordinator.
d. Military Operations Specialist.
e. Automation (Data Systems) Specialist.
f. Central Weather Service Unit Meteorologist.
g. Flight Data Communications Specialist.
h. National Airspace System (NAS) Manager.
i. Oceanic DAPS.
j. Airborne Warning and Control System (AWACS).
k. Aircraft Movement Information System Specialist.

3.4.4.1 Ancillary Position Requirements - Ancillary positions shall be equipped with VSCS position equipment. Ancillary positions shall have the capability to access VSCS A/G and G/G communications. That access shall be classmarked pursuant to the needs and responsibilities associated with each ancillary position activity. Classmarked communications assignments for ancillary positions shall reside in area supervisory personnel and shall reside in position configuration maps as specified in 3.4.5, Supervisory positions, and 3.5.4, System management functions.

3.4.4.2 Special Classmark Requirements - The capability shall be provided for one or more ancillary positions to be classmarked for transmitter/receiver main/standby selection on all frequencies available through the VSCS. The capability shall be provided for one or more ancillary positions to be classmarked for initiating a switchover from the

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3.4.5.2.3 Supervisory Monitoring of Operational Position Displays - The area supervisory positions shall be provided the capability to select, for display at the supervisory position, the display of any operational position within the supervisor's area of responsibility. Operational position displays at the supervisory positions shall be for monitoring purposes only. All visual indications on the cloned display at the area supervisory position shall be identical to and concurrent with those at the selected operational position.

3.4.5.2.4 FTS Monitoring of A/G - The supervisory position(s) shall have the capability to select any A/G frequency at operational positions within its area of responsibility and electronically cross-connect that frequency to an FTS line that has been established via a PABX/VSCS extension. The supervisory position shall have the capability of establishing, maintaining and placing on hold the G/G IP communications with the FTS line, for the duration of time that the FTS is monitoring the A/G circuit, without affecting the A/G to FTS communications cross-connection. Under no circumstances shall these G/G communications be transmitted over the A/G circuit. The FTS line side shall not have talkback capabilities to the A/G circuit. There shall be no degradation in signaling time or of voice quality on the A/G circuit as a result of implementing this feature.

3.4.5.3 Supervisory Control of Position Reconfiguration - The area supervisory position shall be provided with the capability to initiate VSCS communications reconfiguration for ATC positions within the supervisor's designated area of responsibility. The area supervisory position operator shall have the capability to make temporary modifications to assignments and classmarks in position maps for operational ATC positions for contingency purposes. Such temporary modifications shall be in effect until modified again, or until any reconfiguration of the affected position is implemented.

3.4.6 Local Maintenance Position

The VSCS shall provide for one operational position to be designated as the facility local maintenance position. It shall be provided with A/G and G/G communications capability and, in addition, shall have the capability to request, control, display, store, and transfer on-site system tests and test results. All built-in test equipment (BITE) and built-in testing (BIT) shall be accessible from the VSCS local maintenance position. Distribution and protector frames shall be in close proximity to the maintenance position. Patching facilities shall be accessible from the local maintenance position.

3.4.6.1 Local Maintenance Position Equipment - In addition to the console equipment defined in 3.4.9.2, the local maintenance position equipment shall include a programmable test panel and interface ports to support the remote maintenance monitoring system, the maintenance processor system (MPS), digital/analog test signal generators, and other external test equipment required to accomplish tests, measurements, and verifications of the parameters specified in 3.2.2.

3.4.6.1.1 Local Maintenance Position Features - The VSCS shall provide a means to read and store the results of built-in test sequences (BITS), prepare and run extended sequences of parametric tests, select positions or whole sector suites to test/validate the equipment functionality (entry/ display, switching/control, special features), select and connect lines/trunks to perform line service verification, loop maintenance tests, and switching system performance tests. Built-in test equipment (BITE) shall be used to support BITS, parametric tests, and automated test sequences set by the local maintenance position operator or the MPS.

3.4.6.1.2 Test Panel - A test panel shall be provided at the local maintenance position for monitoring and electronically patching IP lines, trunks, A/G, PABX, and all internal and external data communication interfaces and circuits for maintenance access. The test panel shall provide a means for monitoring all outgoing and incoming IP lines, trunks, and circuits. The test panel shall provide a means for connecting to either the line or equipment side of a circuit for test and for isolating a circuit from an external interface for testing. Non-transparent tests on operating VSCS equipment shall be initiated only after confirmation that the equipment is in a standby state, and that such tests will not affect the continued function- ing of any operational positions. After the completion of such tests, the tested equipment, on command or after a preprogrammed time interval, shall revert from the standbv state to an active or ready-for-use state. The test panel shall be arranged to:

a. Make busy tests.

b. Establish an out-of-service condition on a circuit or IP trunk.

c. Talk, monitor, and originate outgoing or incoming calls for testing trunks.

d. Test switching equipment.

e. Test interswitch trunks.

f. Access the line side of all circuits.

3.4.6.2 Local Maintenance Theory of Operation - The local maintenance position shall augment the VSCS BITS/BITE to provide a comprehensive automated maintenance workstation. It shall provide the software and hardware tools required to meet the operations and maintenance criteria necessary to make possible the availability, grade of service, and reliability set forth as requirements in this document. Implementation and operability shall follow methods that are well established in commercial industry applications of automated test equipment, using standard test equipment data busing and measurement techniques (IEEE-488, and current BSTRs).

3.4.7 Data Entry Position

The VSCS shall provide for at least one or more positions to be designated as a data entry position that has the capability to access the VSCS

configuration database, VSCS performance data, traffic analysis data, and system communication status data. Data entry position access to the VSCS database shall not perturb or impede the real-time data and communications processing requirements of the VSCS. The data entry position shall be assignable to an appropriately equipped position.

3.4.7.1 Data Entry Position Equipment - The data entry position shall be provided with a data entry device, a hardcopy printer device, and access to a mass storage media meeting the requirements of 3.5.4, System management functions.

3.4.7.2 Data Entry Position Software - Software shall be provided to enable a data entry position to access and manipulate the VSCS configuration database commensurate with the requirements of real-time VSCS communications traffic analyses as defined in 3.5, Switching and control functions. Access to the VSCS internal data shall be through an interactive human-computer interface approved by the FAA and described and documented in the Human Factors Design Document.

3.4.8 Reconfiguration Connnand Entry and Display

The VSCS entry/display function shall support reconfiguration to all levels specified in 3.5.4.1.1.3, Reconfiguration levels. The entry/display function shall accept position configuration map data from the control function and shall display implemented map data as directed by the control function. The VSCS shall accept reconfiguration commands from designated supervisory positions, the AAS, and the local maintenance position only. Each position with reconfiguration authority shall have the scope of its reconfiguration authority defined by classmark. Authorized personnel shall be able to initiate a reconfiguration of the VSCS by entering the reconfiguration command and logical configuration group or position map(s) to be implemented. AAS reconfiguration command entry, and implementation of a configuration map shall be as specified in 3.5.4.1.1.3, Reconfiguration levels.

3.4.8.1 Configuration Map Access - The entry/display function shall provide authorized personnel access to the VSCS configuration database via the control function. Access to the configuration database shall be provided for, but not limited to, the following requirements.

3.4.8.1.1 Hardcopy Listings of Configuration Maps - The entry/display function shall provide for formatted print output of configuration maps. The printed reports shall show all functional capabilities, restrictions, and assignments for each operational position within the VSCS. Hardcopy output shall be provided upon receipt of a command from classmarked positions.

3.4.8.1.2 Reconfiguration Status Reporting - Reconfiguration status reports shall be made available upon request to the initiator of the reconfiguration, to area supervisors affected by the reconfiguration on visual display, and to other authorized personnel. Status reports shall be

provided upon receipt of a command from a classmarked position.

3.4.8.1.3 Limitations of Reconfiguration - Except where otherwise specified, reconfiguration processing at an operational position shall not modify previously selected display brightness and audio levels, nor change HS or LS selections, M/S TX/RX selections, BUEC selections' or other selections normally controlled by the position operator. For those frequencies migrating to one or more positions, as a result of position or sector reconfiguration, the selected/enabled/disabled status shall be identical at the new position(s) as they were at the old position. In the case where a frequency that was present at more than one position is migrating to one or more positions, and the frequency was selected/enabled at any position, the selected/enabled status shall be identical at the new position(s).

3.4.9 Entry/Display Function Hardware

3.4.9.1 Scope of Entry/Display Function Hardware - The entry/display function hardware shall consist of the following items:

a. Communications control interactive display devices.
b. Data entry devices.
c. IA keypad entry and display devices.
d. Position loudspeaker(s).
e. Supervisory position voice recording and playback devices.

3.4.9.2 VSCS Console Equipment - The VSCS entry/display function console equipment shall include:

a. Two loudspeakers with associated volume controls.

b. Two dual jack modules.

c. Chime with associated volume and on/off control.

d. Display panel(s) supporting A/G communications control functions, G/G communications control functions, or special control functions, or any combination thereof.

e. Entry device for each display panel.

f. Separate IA keypad device.

g. All hardware and associated electronics for the above devices.

3.4.9.2.1 Position Headset/Handset/PTT Jacks - The VSCS shall provide two dual jack modules for each common console. Each jack module shall be capable of accommodating any combination of two headsets or handsets and their associated PTT switches. One jack on each jack module shall provide PTT preemption capabilities. The second jack shall be preemptable. The microphone audio and PTT contacts of the preempting jacks of each jack module shall be paralleled. The microphone audio and PTT contacts of the

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impedance, 5 watt input power. The loudspeaker when driven by VSCS shall meet the speech intelligibility measurement requirements of 3.4.2.3.8.4 at one-half the full volume setting. Loudspeaker grill material shall be of an accoustically transparent material.

3.4.9.3.5 Chimes - A chime device shall be provided for each VSCS common console to alert the operator to incoming G/G communications. The chime device shall be capable of generating five distinct chime tones. The device shall provide selectability of a tone for a given console position by facility maintenance personnel; the console position operator shall not be allowed the capability of changing the tone. The chime device audio shall be available to the position operator through the position G/G loudspeaker.

3.4.9.3.5.1 Chime Volume - A combination on/off switch and volume control and a visual on/off status indicator shall be collocated with t-he chime device. The chime volume control and the LS volume control shall be coupled in such a way that the chime volume remains discernibly below the LS volume when the LS volume control is adjusted up or down. Adjustments to the chime volume control shall not couple to the LS and shall permit adjustment of the chime volume additionally lower than LS volume.

**3.4.10** Location of Console Equipment

The VSCS console equipment shall be located within and on the S/S common console in accordance with the VSCS-ACCC (Common Console) IRD (see 3.6.2).

3.4.11 C/C Equipment Power

Electrical power supplies for VSCS console equipment shall be provided so that the loss of power at any one common console shall not affect the power available at or to any other common console. The power required for all VSCS console equipment at a position shall not exceed 510 Watts.

## 3.5 SWITCHING AND CONTROL FUNCTIONS

The switching and control functions shall provide all voice interconnections between positions in a facility, between positions at a facility and positions at other facilities, and between designated A/G positions and the A/G and BUEC interfaces. The switching and control functions shall provide interface control signaling between the display function and all switching interfaces to implement connections initiated either by position operators or from switching interfaces. The control mechanisms required to establish, control, monitor, and disconnect communications shall be provided. Special features, as specified in 3.3 and 3.4, shall be provided and shall include, but not be limited to, the following:

a. IC (DA and IA).
b. IP (DA and IA).
c. A/G communications.
d. Confcrencing.
e. Call forwarding.
f. Call transfer.
g. OVR.

Maintenance and system management functions shall be provided by the switching and control functions and shall include, but not be limited to, the following:

a. Real-time quality control (RTQC).
b. Reconfiguration.
c. Reconfiguration database management.
d. Traffic data collection, reduction, and analysis.
e. System timing.

### 3.5.1 Design Considerations

**3.5.1.1** Modularity - The switching and control functions shall be modular in construction to meet the size and expansion requirements specified in 3.2. The switching and control functions shall be designed to handle the traffic loads as specified in Tables II and III.

3.5.1.2 Program Control - The switching and control functions shall be under stored program control.

3.5.1.3 Technology Utilization - The design of the switching and control functions shall use cost-effective applications of proven hardware, software, and firmware technology. Main switching elements shall not use electromechanical relays. Software/firmware shall be prepared in accordance with 3.10.

3.5.1.4 G/G Interface Compatibility - The trunk and PABX G/G interfaces shall be such that the G/G interfaces may interchangeably be installed in the same circuit location.

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Table XI. A/G Connectivity

| Percentage of All Positions | Number of Connectivities Assigned to a Position at One Time |
|---|---|
| 40 | 0 |
| 20 | 4 |
| 13 | 6 |
| 14 | 10 |
| 9 | 14 |
| 3 | 18 |
| 1 | 24 |

Note:
The number of positions shall be the integer greater than or equal to the product of the percentage and the number of positions in the facility.

Table XII. A/G Fan-in and Fan-out

| Percentage of all Interfaces | Number of Positions Assigned with the Fan-in Feature | Number of Positions Assigned with the Fan-out Feature |
|---|---|---|
| 60 | 6 | 6 |
| 40 | 12 | 12 |

Note:
(1) The number of interfaces shall be the integer greater than or equal to the product of the percentage and the number of A/G interfaces in the facility.

(2) This table does not include interfaces for emergency or tactical frequencies where the 12 positions per interface shall always be available.

Table XI. A/G Connectivity

| Percentage of All Positions | Number of Connectivities Assigned to a Position at One Time |
|---|---|
| 40 | 0 |
| 20 | 4 |
| 13 | 6 |
| 14 | 10 |
| 9 | 14 |
| 3 | 18 |
| 1 | 24 |

Note:
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|---|---|---|
| 60 | 6 | 6 |
| 40 | 12 | 12 |

Note:
(1) The number of interfaces shall be the integer greater than or equal to the product of the percentage and the number of A/G interfaces in the facility.

(2) This table does not include interfaces for emergency or tactical frequencies where the 12 positions per interface shall always be available.

3.5.2.1.1.6 Weather Recording Broadcast - The VSCS shall provide the capability for accessing a designated weather recording channel and for monitor only or for monitor and broadcast of the accessed weather recording. The VSCS shall be capable of generating PTT signalling and voice connectivity from the weather recording channel to the A/G interface for broadcast. The VSCS shall be capable of providing the weather recording broadcast to all frequencies selected and enabled for transmission at the position selecting the weather recording broadcast. The VSCS shall provide for monitor only and for monitor concurrent with broadcast for the designated weather recording to the requesting operational position. The VSCS shall provide for termination of weather recording access (and generation of a trunk disconnect signal) by a PTT action by the requesting position operator, by a valid PTT preemption by another operator, or by recognition of an end-of-message indication (trunk disconnect) on the weather recording channel, as described in the VSCS-WEATHER IRD. Subsequent weather recording accesses, following termination of the current access, shall require a new weather recording selection per 3.3.1.1.9.2 and shall begin at the start of the selected weather message.

3.5.2.1.1.7 PTT Lockout - The VSCS shall provide PTT lockout capability to restrict transmission to a single user at a time at each RCE interface, existing radio interface, or BUEC interface. The capability to lock out other attempted transmissions shall exist for the duration of the PTT that caused the initiation of the lockout capability.

3.5.2.1.1.7.1 RCE Trunk Lockout Signal - Upon recognizing a trunk lockout signal from a RCE interface, the VSCS shall enable a PTT lockout capability to all operational positions assigned access to transmission on the RCE interface through the fan-out feature. This function is not availab'le with the existing radio interfaces.

3.5.2.1.1.7.2 PTT Lockout for Multiple Assignments of a Frequency - When PTT is actuated at a position for a frequency selected for transmission, a PTT lockout function shall be activated within the VSCS to inhibit any other attempted transmissions on the affected frequency as defined by the fan-out feature to the RCE interface, existing radio interface, or BUEC interface for that frequency.

3.5.2.1.1.8 Preemption

3.5.2.1.1.8.1 Position Jack Preemption - Position jack preemption shall be provided through the jack modules described in 3.4.9, Entry/display function hardware.

3.5.2.1.1.8.2 PTT Preemption - For PTT preemption as specified in 3.3, the switching function shall establish the preemptor for voice transmission and PTT signaling. The preempted position shall be provided an alert indicating preemption and shall be provided signaling and voice to monitor the pre-empting transmissions on that frequency. The PTT preemption capability shall be contained in the position map(s). No more than one position shall be capable of preempting other positions that have been assigned access to the same RCE interface, existing radio interface, or BUEC interface through the fan-out feature.

3.5.2.1.1.8.3 Weather Broadcast Preemption - The capability shall be

provided for the position operator at an operational position that has the weather recording broadcast enabled to disable the weather recording broadcast on all selected frequencies at the position by a PTT action. PTT lockout and PTT preemption classmarks shall apply at other operational positions that have assigned frequencies common with any of those at the weather broadcast position, should those positions attempt PTT during the weather recording broadcast.

3.5.2.1.1.8.4 Cross-coupling Preemption - While the switching function is generating PTT for cross-coupling and providing voice to the frequency designated for transmission, any operational position's activation of PTT for the interface shall preempt the cross-coupled transmission and shall establish the preemptor for voice transmission and PTT signaling. Upon PTT release by the preemptor, the cross-coupling capability shall be reestablished.

### 3.5.2.1.2 A/G Using RCE or Existing Radio Interfaces

3.5.2.1.2.1 Configuration for A/G - The VSCS configuration data shall contain a list of all VSCS ports used to access the RCE or existing radio interfaces.

The VSCS shall be capable of establishing the M/S selection and receiver remote muting status to be in agreement with the last operational configuration.

3.5.2.1.2.1-d Configuration for RCE - The VSCS shall be capable of requesting and storing data information from RCE on the RCE configuration that shall include, but not be limited to:

a. Frequencies.

b. Sites for each frequency with transmission and reception collocated; otherwise, sites for transmission and sites for reception for each frequency.

c. RCE interface module to access from the VSCS for each frequency site.

d. Frequency selective or split mode operation.

The VSCS shall be capable of receiving data information from the RCE, as specified in the VSCS-RCE IRD (see 3.6.5), and of modifying the on-line RCE configuration within the VSCS without disturbing calls in progress or losing incoming communications. All data information received from the RCE shall be made available as specified in 3.5.3, Supervisory and maintenance requirements.

3.5.2.1.2.1.2 Configuration for Existing Radio Interfaces - The existing radio interfaces do not have the capability of supplying data information.

3.5.2.1.2.2 Frequency Selection - The switching function shall recognize a request for a frequency selection from an operational position that has the frequency assigned. The VSCS shall then enable the established voice and

I signaling communication paths to the RCE or existing radio interface, providing the operational configuration for the interface has not been I assigned to BUEC, and shall enable the recognition of position requests for:

a. Enabling/disabling transmission.
b. Enabling/disabling reception of voice.
c. MIS selection.
d. Remote receiver muting control and local position muting.
e. PTT keying.
f. Cross-coupling.

The position requesting frequency selection shall be provided a frequency selection confirmation from the switching function that shall include the operational status of the M/S control for transmission and reception, remote receiver muting control, and cross-coupling.

3.5.2.1.2.2.1 Frequency Deselection - The switching and control functions shall recognize a request for a frequency deselection for a RCE or existing radio interface at an operational position that has the frequency selected. Deselection shall result in the following:

a. Voice shall neither be provided to the RCE or existing radio interface nor to the position from the RCE or existing radio interface.

b. Only the request for frequency selection shall be recognized from the operational position for the RCE or existing radio interface.

c. The operational position shall continue to receive signaling associated with the fan-in and fan-out features.

3.5.2.1.2.3 PTT and Voice Transmission - VSCS transmission over a frequency shall be controlled by PTT keying at an operational position with the frequency selected for transmission. The VSCS shall provide PTT I signaling at the RCE interface or the existing radio interface for the I frequency while PTT is engaged. The VSCS shall inhibit simultaneous PTT I keying on each frequency interface. The switching function shall provide I PTT signaling to the RCE interface or existing radio interface when PTT on a frequency is recognized, shall provide voice transmission, and, for the RCE interface only, shall expect PTT confirmation from the RCE. The existing radio interfaces do not provide PTT confirmation and the VSCS shall generate I them internally. The VSCS shall recognize a continuous PTT confirmation from the RCE interface while receiving the RCE interface PTT confirmation signal. The VSCS shall continue to generate the internal PTT confirmation I signal for the existing radio interfaces so long as PTT is being sent to these interfaces. The switching function shall provide the PTT confirmation to the originator of the PTT, shall enable a PTT lockout capability to all other positions that have selected the frequency, and shall provide a squelch break signal, or equivalent, to all positions that have the frequency assigned that shall indicate that voice transmission is occurring. An alert shall be provided to the maintenance position when PTT confirmation is expected but is not received from the RCE interface within 500 ms.

When PTT is released, appropriate signaling, control, and status shall be I similarly distributed to the RCE interface or existing radio interfaces and to all

I signaling communication paths to the RCE or existing radio interface, providing the operational configuration for the interface has not been I assigned to BUEC, and shall enable the recognition of position requests for:

a. Enabling/disabling transmission.
b. Enabling/disabling reception of voice.
c. MIS selection.
d. Remote receiver muting control and local position muting.
e. PTT keying.
f. Cross-coupling.

The position requesting frequency selection shall be provided a frequency selection confirmation from the switching function that shall include the operational status of the M/S control for transmission and reception, remote receiver muting control, and cross-coupling.

3.5.2.1.2.2.1 Frequency Deselection - The switching and control functions shall recognize a request for a frequency deselection for a RCE or existing radio interface at an operational position that has the frequency selected. Deselection shall result in the following:

a. Voice shall neither be provided to the RCE or existing radio interface nor to the position from the RCE or existing radio interface.

b. Only the request for frequency selection shall be recognized from the operational position for the RCE or existing radio interface.

c. The operational position shall continue to receive signaling associated with the fan-in and fan-out features.

3.5.2.1.2.3 PTT and Voice Transmission - VSCS transmission over a frequency shall be controlled by PTT keying at an operational position with the frequency selected for transmission. The VSCS shall provide PTT I signaling at the RCE interface or the existing radio interface for the I frequency while PTT is engaged. The VSCS shall inhibit simultaneous PTT I keying on each frequency interface. The switching function shall provide I PTT signaling to the RCE interface or existing radio interface when PTT on a frequency is recognized, shall provide voice transmission, and, for the RCE interface only, shall expect PTT confirmation from the RCE. The existing radio interfaces do not provide PTT confirmation and the VSCS shall generate I them internally. The VSCS shall recognize a continuous PTT confirmation from the RCE interface while receiving the RCE interface PTT confirmation signal. The VSCS shall continue to generate the internal PTT confirmation I signal for the existing radio interfaces so long as PTT is being sent to these interfaces. The switching function shall provide the PTT confirmation to the originator of the PTT, shall enable a PTT lockout capability to all other positions that have selected the frequency, and shall provide a squelch break signal, or equivalent, to all positions that have the frequency assigned that shall indicate that voice transmission is occurring. An alert shall be provided to the maintenance position when PTT confirmation is expected but is not received from the RCE interface within 500 ms.

When PTT is released, appropriate signaling, control, and status shall be I similarly distributed to the RCE interface or existing radio interfaces and to all

(see 3.6.5 or 3.6.15). Upon confirmation of the change in state from the RCE interface, or existing radio interface that returns confirmation, the switching function shall provide a confirmation signal of the change to all positions that are assigned the frequency. For existing radio interfaces that do not return confirmation, the VSCS shall generate these confirmations internally and provide them to the positions for display. For all interfaces, the position visual indications shall provide status in accordance with 3.3, Operational requirements.

3.5.2.1.2.6 Enabling/Disabling Transmission/Reception - When a frequency has been selected at a position, the switching function shall recognize requests for enabling or disabling transmission or reception for that frequency from the position and shall implement the request and provide an indication to the position.

3.5.2.1.3 A/G Using BUEC - The VSCS shall be capable of accessing the tunable BUEC transceivers via the appropriate BUEC system, as described in the VSCS-BUEC IRD (see 3.6.6).

3.5.2.1.3.1 BUEC Interface Configuration - The VSCS configuration database shall contain frequencies and corresponding assigned BUEC access ports and shall contain the operational positions that shall be capable of selecting the BUEC for each frequency.

3.5.2.1.3.2 BUEC Selection and Signaling

3.5.2.1.3.2.1 Request Selection - The switching function shall recognize a request for a BUEC frequency access from an operational position that has the frequency selected and BUEC access permitted, which shall enable both transmission and reception of voice. The switching function shall store the operational configuration of the RCE interface or existing radio interface selections for each position assigned the frequency and shall disable PTT to the RCE interface or existing radio interface for the frequency. The VSCS shall then enable voice and signaling to the assigned BUEC access port from all positions with the frequency selected. The switching function shall recognize a BUEC SELECT signal from the position and shall deliver it to the assigned port. An alert shall be provided to the maintenance position when a priority module or malfunction indication is expected, but is not received within 10 seconds.

3.5.2.1.3.2.2 Malfunction Indication - Upon receiving the malfunction, MALF, from the BUEC interface, all positions with the frequency selected and the area supervisory position shall receive an alarm to indicate the BUEC access malfunction. The switching function shall automatically assume a BUEC deselection.

3.5.2.1.3.2.3 Priority Indication - Upon determination of the BUEC priority module accessed, all positions with that frequency selected shall be provided with the site mnemonic of the selected BUEC site, as determined by the priority module number, and the switching function shall be enabled for recognition of position requests for:

a. PTT keying.
b. BUEC deselection.

Cross-coupling associated with the frequency shall automatically be disabled.

3.5.2.1.3.2.4 Request Deselection - Upon recognizing a BUEC deselection request, a control signal shall be provided to the assigned port for the frequency to effect deselection. PTT signaling shall be disabled from BUEC. The switching function shall then reestablish the most recent operational configuration of transmission and reception with the A/G interface for each assigned position's previously stored selections.

3.5.2.1.3.2.5 Voice Communications Interface - The voice communications and signaling shall be as described in the VSCS-BUEC IRD (3.6.6).

3.5.2.1.3.2.6 Command and Status Signal Interface - The command and status signals at the BUEC interface shall be as described in the VSCS-BUEC IRD (see 3.6.6).

3.5.2.1.3.3 PTT and Voice Transmission - VSCS transmission over a frequency shall be controlled by PTT keying at an operational position with the frequency selected for BUEC transmission. The VSCS shall provide PTT signaling at the BUEC interface for the frequency while PTT is engaged. The VSCS shall use the PTT lockout function to inhibit simultaneous keying of a frequency. The switching function shall provide PTT signaling to the BUEC interface when PTT on a frequency is recognized and shall provide voice transmission. The switching function shall provide an indication that PTT has reached the priority module interface to all positions assigned the frequency and shall activate a PTT lockout capability to all positions that have selected the frequency except the position activating PTT.

When PTT is released, appropriate signaling, control, and status indications shall be similarly provided.

3.5.2.1.3.3.1 PTT Signal Interface - The PTT signal shall be as described in the VSCS-BUEC IRD (see 3.6.6).

3.5.2.1.3.4 BUEC Voice Reception - Voice reception signals and control shall be as specified in the VSCS-BUEC IRD (see 3.6.6). The VSCS shall recognize voice signals from the BUEC interface as a squelch break. The switching function shall provide voice to all positions that have the frequency selected.

3.5.2.1.4 A/G Backup Switch Operation - The VSCS shall include a physically separate A/G backup switch to ensure the availability of all of the VSCS A/G communication functions. When the A/G backup switch is used, it shall assume all A/G switching functions previously handled by the A/G primary switch. The A/G backup switch shall provide the same signaling and voice communication connectivity from the operational position to A/G and BUEC interfaces as does the A/G primary switch, but using separate paths.

3.5.2.1.4.1 Hot Backup - The A/G backup switch shall be a hot backup; that

is, it shall be up and available to replace the A/G primary switch in case of degraded operation in the primary switching function. The A/G backup switching function shall be configured with the same map or the same maps that configure the A/G primary switching function. The A/G primary and A/G backup switches shall maintain synchronous and identical A/G operational configurations. The A/G primary and A/G backup switches shall be designed such that the failures or effects of failures in either switch cannot propagate to the other switch. The A/G backup switching function shall periodically run its self-diagnostics and report its status.

3.5.2.1.4.2 Total Switchover - The A/G backup switch shall be switched into operation as a complete function; the A/G backup switching function shall not be switched into the A/G communication path for individual channels.

3.5.2.1.4.3 A/G Backup Switch Switchover Threshold - The A/G communication shall be switched to the A/G backup switch when an A/G primary switch failure has been detected. The A/G backup switch failure and switchover to primary switch threshold shall be the same threshold as that for the primary switch. An A/G switch failure shall be defined to exist when 10% or more of the assigned frequencies within a facility are not operational within the switching and control functions. The switchover to the A/G backup switch shall not affect the G/G configuration or operations.

3.5.2.1.4.4 A/G Backup Switch Manual Recovery - After a failure of the operational A/G switch, return to that A/G switch shall. be manually controlled by the maintenance position. In the event that both of the A/G primary switch and the A/G backup switch exceed preestablished failure thresholds, manual control of the switchover process shall be provided at the maintenance position.

3.5.2.2 GIG Communications - The switching and control functions shall provide all call processing including control and supervisory signaling and voice connectivity for all IC and IP calls to and from any active VSCS G/G interactive display panel. The switching and control functions shall provide call processing for all VSCS switching features and also for all calls requiring trunk access to positions or services external to the VSCS.

3.5.2.2.1 Call Processing - The switching and control functions shall include, but not be limited to, the following program controlled capabilities:

a. Recognize a call request and provide dial tone if applicable.

b. Recognize calling source.

c. Recognize type of call requested (DA, IA, conference, etc.).

1. Look up called number.
2. Process dialed number.

d. Determine and select path to called source.

e. Test path availability.

f. Test path continuity.

g. Verify absence of foreign potentials.

h. Signal called source.

i. Monitor status of call.

j. Provide applicable signaling information of status of call to calling and called parties.

1. Ring back.
2. Ringing.
3. Tones.

k. Take down path when there is a disconnect by appropriate party.

3.5.2.2.2 VSCS Switch Features - The switching and control functions shall include, but not be limited to, the following VSCS features:

a. Calling source identification.
b. Direct access.
c. Direct access with override.
d. Indirect access.
e. Indirect access with override.
f. Conferencing.
g. Voice call.
h. Call forwarding.
i. Call transfer.
j. Call hold.
k. Voice routing.

3.5.2.2.2.1 Calling Source Identification - The switching and control functions shall identify the calling source to the called party when both are using interactive display panels terminated on a VSCS. The switching and control functions shall identify the trunk on incoming non-VSCS originated calls. For VSCS-to-VSCS calls, and wherever else possible, the VSCS shall translate the numbering plan's calling number to an alphanumeric calling party designator and shall provide that designator to the display function.

3.5.2.2.2.2 DA Calls - The switching and control functions shall provide connectivity from the display function for DA (both IC and IP) calls by converting the call processing address digits of the desired destination into the appropriate connections. The call processing sent to the called party shall include call feature information. Except for incoming OVR calls and calls in HOLD, DA call selection shall release the position from a previous IC or IP call and establish a DA path to the new position.

3.5.2.2.2.2.1 Calling Party DA - For a DA call, DA actuation at the position shall cause switch connectivity to be established to the called position. For an IP DA call, DA actuation at the position shall initiate the

e. Test path availability.

f. Test path continuity.

g. Verify absence of foreign potentials.

h. Signal called source.

i. Monitor status of call.

j. Provide applicable signaling information of status of call to calling and called parties.

1. Ring back.
2. Ringing.
3. Tones.

k. Take down path when there is a disconnect by appropriate party.

3.5.2.2.2 VSCS Switch Features - The switching and control functions shall include, but not be limited to, the following VSCS features:

a. Calling source identification.
b. Direct access.
c. Direct access with override.
d. Indirect access.
e. Indirect access with override.
f. Conferencing.
g. Voice call.
h. Call forwarding.
i. Call transfer.
j. Call hold.
k. Voice routing.

3.5.2.2.2.1 Calling Source Identification - The switching and control functions shall identify the calling source to the called party when both are using interactive display panels terminated on a VSCS. The switching and control functions shall identify the trunk on incoming non-VSCS originated calls. For VSCS-to-VSCS calls, and wherever else possible, the VSCS shall translate the numbering plan's calling number to an alphanumeric calling party designator and shall provide that designator to the display function.

3.5.2.2.2.2 DA Calls - The switching and control functions shall provide connectivity from the display function for DA (both IC and IP) calls by converting the call processing address digits of the desired destination into the appropriate connections. The call processing sent to the called party shall include call feature information. Except for incoming OVR calls and calls in HOLD, DA call selection shall release the position from a previous IC or IP call and establish a DA path to the new position.

3.5.2.2.2.2.1 Calling Party DA - For a DA call, DA actuation at the position shall cause switch connectivity to be established to the called position. For an IP DA call, DA actuation at the position shall initiate the

3.5.2.2.2.4 OVR - The VSCS shall establish the connectivity for an IC or IP OVR call between calling and called parties, with no actions being required by the called party to answer the call. The OVR connectivity shall be in addition to any current communication connectivity at the called position. The OVR calling party shall join in any ongoing GIG communications at the called position. The OVR calling party shall receive, over the OVR voice channel, all A/G communications emanating from the called position, and all A/G and GIG communications directed to the called position that are routed to the called position's HS. The OVR calling party's voice shall not be transmitted over the called position's A/G communications,

3.5.2.2.2.4.1 OVR Signaling - After the connection has been made, an audible signal shall be provided to both the calling and called positions to indicate that the OVR connection is complete, The audible signal shall be a 0.2-second burst of dial tone (zip tone) for the first incoming OVR at the called position. A distinct, modified dial tone shall be the audible signal when the called position already has at least one incoming OVR connection and the incoming OVR is the second or subsequent simultaneous OVR. When the simultaneous OVR conference limit has been exceeded, a third distinct, modified dial tone shall be used to indicate each subsequent incoming two-party OVR call.

3.5.2.2.2.4.2 Calling Party DA OVR - When a DA assigned the OVR feature is actuated, the connectivity to the called position shall be established by the switching and control functions. When the DA is classmarked to require GIG PTT, the position shall continue to use PTT with the overridden position even after being itself overridden by a third position.

3.5.2.2.2.4.3 Calling Party IA OVR - IA OVR calls shall originate from any position having IA OVR capability as permitted by classmarks. Upon selection of an IA at a position and the receipt of a dial tone from the switching function, the dialing of a special OVR code and the desired position number, the voice connection between the calling and the called positions shall be established by the switching and control functions.

3.5.2.2.2.4.4 Called Party - No action shall be required by the called party to complete the connection for an OVR call. The switching function shall provide the capability for the calling party to join in ongoing GIG calls at the called position, subject to available OVR conference resources. OVR calls shall not be transmitted over A/G.

3.5.2.2.2.4.5 Initiating Calls During an OVR - The switching and control functions shall provide the necessary capability such that the receipt of an OVR call at a position shall not inhibit the position from placing an IC, IP, or A/G call while being overridden.

3.5.2.2.2.4.6 Simultaneous OVR - The capability and resources shall be provided by the VSCS for any operational position to be simultaneously overridden by up to five other positions, or by one less than the simultaneous OVR limit, whichever is greater. If any of the parties overriding a single position are themselves being overridden, all parties shall be connected to form one composite OVR conference call, subject to the simultaneous OVR conference limitation.

3.5.2.2.2.4.7 Simultaneous OVR Conference Limitation - The switching and control functions shall store the information of which positions are in an

OVR call so that the OVR of any position shall be prohibited when the called position to be overridden is already overriding the calling position. The limit of the number of positions involved in a simultaneous OVR shall be at least 6, including the overridden position. A capability shall exist within the VSCS for at least 32 simultaneous OVR conferences.

3.5.2.2.2.4.8 Extended OVR Capability - When a simultaneous OVR conference call has reached the OVR conference size limit, further attempts to override any of the participants in the OVR conference shall not be blocked, but shall be established from the overriding position to the overridden position as a two-party OVR call. As each simultaneous OVR conference call reaches the simultaneous OVR limit, an alert indicating that an OVR conference resource is not available shall be sent to the maintenance position.

3.5.2.2.2.4.9 OVR Release - When the calling party disconnects from an OVR call, the switching and control functions shall take down and release all resources used for that call.

3.5.2.2.2.5 Conferencing - The switching and control functions shall provide resources for and establish conferences initiated through DA or IA activation at the display function. The conferencing capability shall include access to IC and IP conferees. Conferencing capability shall provide for conference sizes of up to 10 simultaneous conferees. The number of simultaneous conferences capable shall be at least 16. Conference calls shall not be limited by the number of OVR calls or voice calls within the VSCS.

3.5.2.2.2.5.1 Meet-me Conference - The switching and control functions shall provide an internal bridge, or equivalent, and resources to establish simultaneous meet-me conferences.

3.5.2.2.2.5.2 Progressive Conference - The switching and control functions shall provide the internal signaling and resources to establish progressive conferencing by adding positions to the conference as they are identified and connected.

3.5.2.2.2.5.3 Preset Conference - The VSCS shall provide for automatically signaling designated positions including automatic dialing to establish a preset conference.

3.5.2.2.2.6 Voice Call - The switching and control functions shall provide positions with the capability to activate or join a voice call to positions at another. facility or to positions at more than one facility over multipoint IP trunk circuits. The maximum number of positions capable of simultaneously accessing an outgoing voice call trunk shall not exceed five at any facility. Incoming IP voice calls shall be assignable to positions or group of positions within a facility. A capability shall exist within the VSCS for at least 100 voice call trunks.

3.5.2.2.2.6.1 Voice Call, Calling Position - Selection of a DA voice call circuit at a position shall initiate call processing to connect with the selected trunk and to signal all other positions that can access that trunk that it is in use. The original DA voice call selection shall complete the voice call circuit permitting voice paging of the desired positions at the

called facility. Positions within a VSCS, to the voice call limit, shall be capable of joining the busy voice trunk on a conferencing basis by selection of the appropriate DA control. The sixth position attempting to join the voice call shall receive a busy signal.

3.5.2.2.2.6.2 **Voice Call,** Called Position - When the voice call is answered by operation of any DA voice call control for that circuit, the applicable switching and control functions shall signal all positions served by the voice circuit that the call has been answered. Connectivity shall be established by the switching function ***only*** to the answering position. A n y position with DA access to this busy trunk shall be capable of joining on a conferencing basis.

3.5.2.2.2.6.3 Voice Call, IA - The capability shall be provided to dial-up through IA any voice call circuit available to the VSCS. Accessing the voice call circuit by IA selection shall initiate all appropriate signaling as for DA selection. If the IA call attempts a call on a busy circuit, the call shall be connected to the busy **circui**t provided that this call is not the sixth call at a **faci**lity. If it is the sixth, the call shall not access the voice call, but shall receive a busy signal.

3.5.2.2.2.6.4 Voice Call Release - Releas**s**e of the circuit by the last position at either the calling or called facility shall disconnect the voice call. The voice call circuit shall be released by initiating a call disconnection.

3.5.2.2.2.7 Call Forwarding - The switching and control functions shall provide the capability to redirect any incoming 'GIG call from one position to another position within the same vscs. A switching function shall automatically release any position having initiated call forwarding from receiving all subsequent calls until the forwarding feature is disabled.

**3.5.2.2.2.8** Call Transfer - The switching and control functions shall provide the connectivity from the calling position to' the transferred-to position and shall provide associated signaling.

3.5.2.2.2.9 Call HOLD - The switching and control functions shall provide the signaling and resources to hold calls and to resume calls as specified in 3.3.2.2.4.4.2, CA queue depth; and 3.3.2.2.5, Call hold.

**3.5.2.2.2.10** Voice Routing - The **switching and** control functions shall provide voice routing for position monitoring, supervisory recording, voice recording, and **HS/LS** selection, and position relief briefing recording.

**3.5.2.2.2.10.1** Monitoring - The switching and control functions shall recognize a request for monitoring from the entry/display function and shall establish the connectivity to

called facility. Positions within a VSCS, to the voice call limit, shall be capable of joining the busy voice trunk on a conferencing basis by selection of the appropriate DA control. The sixth position attempting to join the voice call shall receive a busy signal.

3.5.2.2.2.6.2 **Voice Call,** Called Position - When the voice call is answered by operation of any DA voice call control for that circuit, the applicable switching and control functions shall signal all positions served by the voice circuit that the call has been answered. Connectivity shall be established by the switching function ***only*** to the answering position. A n y position with DA access to this busy trunk shall be capable of joining on a conferencing basis.

3.5.2.2.2.6.3 Voice Call, IA - The capability shall be provided to dial-up through IA any voice call circuit available to the VSCS. Accessing the voice call circuit by IA selection shall initiate all appropriate signaling as for DA selection. If the IA call attempts a call on a busy circuit, the call shall be connected to the busy **circui**t provided that this call is not the sixth call at a **faci**lity. If it is the sixth, the call shall not access the voice call, but shall receive a busy signal.

3.5.2.2.2.6.4 Voice Call Release - Relea**s**e of the circuit by the last position at either the calling or called facility shall disconnect the voice call. The voice call circuit shall be released by initiating a call disconnection.

3.5.2.2.2.7 Call Forwarding - The switching and control functions shall provide the capability to redirect any incoming 'G/G call from one position to another position within the same vscs. A switching function shall automatically release any position having initiated call forwarding from receiving all subsequent calls until the forwarding feature is disabled.

3.5.2.2.2.8 Call Transfer - The switching and control functions shall provide the connectivity from the calling position to' the transferred-to position and shall provide associated signaling.

3.5.2.2.2.9 Call HOLD - The switching and control functions shall provide the signaling and resources to hold calls and to resume calls as specified in 3.3.2.2.4.4.2, CA queue depth; and 3.3.2.2.5, Call hold.

**3.5.2.2.2.10** Voice Routing - The **switching and** control functions shall provide voice routing for position monitoring, supervisory recording, voice recording, and **HS/LS** selection, and position relief briefing recording.

**3.5.2.2.2.10.1** Monitoring - The switching and control functions shall recognize a request for monitoring from the entry/display function and shall establish the connectivity to

shall detect an incoming voice call by the presence of incoming voice signals on the line. Detection of voice signals below the threshold shall not cause the VSCS to respond to the signals. The threshold shall be -26 dBm0 (nominal test level).

3.5.2.2.3.4 Selective Signaling - The switching and control functions shall provide the capability to both receive telephone calls and originate calls to existing systems equipped with selective signaling systems. The switching and control functions shall make the necessary code translations to be compatible with the numbering plan used in the 300 system. The switching and control functions shall include the capability to emulate all signals for IP trunks to interface existing systems.

3.5.2.2.3.5 Immediate Dialing (Type 7) - The switching and control functions shall be capable of transmitting and receiving standard dial addressing as described in the VSCS-Trunks IRD.

3.5.2.2.3.6 Trunk Signaling, VSCS-PABX - The switching and control functions shall provide appropriate signaling to interface with the existing PABX for access to PSTN and FTS.

3.5.3 Supervisory and Maintenance Requirements

3.5.3.1 Internal VSCS Interfaces - The VSCS design shall provide for centralized access to VSCS control functions and data.

3.5.3.1.1 Centralized Operator Communication - The VSCS shall provide centralized access at designated positions for issuing of commands for functions that include, but are not limited to, status monitoring, performance monitoring, traffic data collection, RTQC information, and diagnostics initiation and results reporting.

3.5.3.1.1.1 Supervisory Positions - The VSCS shall include supervisory positions. Supervisory positions shall have access to control that includes, but is not limited to, requesting reconfiguration, establishing training positions, modifying the on-line functional capabilities of positions, monitoring status, monitoring performance, and requesting special monitoring or playback functions.

3.5.3.1.1.2 Maintenance Position - The VSCS shall include a maintenance position. The maintenance position shall have access to controls that will provide capabilities to perform all diagnostics and certification actions as described in 3.8. The maintenance position shall have the capability to create and maintain access privileges for remote access to the VSCS, including the remote maintenance terminal.

3.5.3.1.2 Centralized Database - The VSCS shall provide centralized access to any on-line databases. The database design document required in 3.10

shall include those features of the database design applicable to switching and control functions.

3.5.3.2 Status Monitoring and Control - The monitoring of real-time system performance, the reporting of system status and failures, and the local maintenance control over system resources to facilitate continuation or restoration of VSCS operational service shall be provided to support RTQC. The status monitoring and control functions shall be consistent with the reliability and maintainability requirements in 3.7, and meet the maintenance functions in 3.1.9.

3.5.3.2.1 Operations Status Monitoring - The capability shall be provided to monitor operational functions to include, at a minimum, monitoring the operational status of A/G and G/G of all assignments within a facility. The status of these conditions shall be available for display at maintenance, supervisory, and designated ancillary positions.

3.5.3.2.2 Performance Status Monitoring - A real-time system performance monitor shall be provided to monitor system equipment status and report failures for dissemination to maintenance and supervisory personnel. Results from periodic self-tests of equipment and indication of equipment failures shall be provided. This shall comprise, at a minimum, test reports on equipment, processors, memory, peripherals, internal interfaces, radio trunks, inter-facility trunks, and the BUEC interface. Data paths shall be monitored by error detection and correction programs to ensure the integrity of transmitted messages. The data communications interfaces to external systems shall be monitored.

**3.5.3.2.2.1** Performance Reporting - System equipment status, the detection of system failures, and the recovery measures taken shall be reported to the maintenance position, the MPS, supervisory positions as classmarked, and to I the ACCC. In addition, the status, failure, and recovery of trunks shall be I reported to the NMCE.

3.5.3.2.2.1.1 Reports to Maintenance Position - System status shall be available at a **5-second** periodic rate. Status output shall be selectable. In the event of a failure, an indication identifying the failed equipment, its relationship to the system, and a way of maintaining the level of availability shall be provided. Audible and visible alarms indicating the failure status shall be provided. Failures shall be categorized, prioritized, and stamped with time of detection in terms of Greenwich Mean Time (GMT). Where audible alarms are used, a muting capability shall be provided. All failure alarms shall be maintained until the problem has been resolved. Recovery alternatives shall be selectable.

3.5.3.2.2.1.2 Reports to MPS - Requested status information shall be sent I to the MPS in accordance with the VSCS-MPS IRD (see 3.6.4). In the event of a failure within the VSCS, notifications **and specifications** of the failure shall be sent to the MPS.

3.5.3.2.2.1.3 Reports to Supervisory Positions - Supervisory positions, as classmarked, shall be notified of position equipment failures within their

area of supervision within 1 second of failure detection.

3.5.3.2.2.1.4 Reports to ACCC - Health status reports, failure, and recovery notifications shall be routed to the ACCC in accordance with the VSCS-ACCC IRD (see 3.6.3).

3.5.3.2.2.1.5 Reports to NMCE - Trunk status reports, failure, and recovery notifications shall be routed to the NMCE in accordance with the VSCS-NMCE IRD (see 3.6.13).

3.5.3.2.2.2 Failure Logging - All failures as reported to the maintenance position shall be logged and stored. The capability shall be provided to format failure reports and select output data according to, at a minimum, date, time, and equipment type for display and hardcopy output.

3.5.3.2.3 Control - Automatic switchover to redundant equipment, as available, shall be provided in the event of a failure. The recovery time shall be within limits specified in 3.7.2, Reliability. The maintenance position shall be provided the capabilities required to control the recovery from system failures, the execution of diagnostics, and the output resulting from the monitoring function.

3.5.3.2.3.1 Failure Recovery - In the event of system fault or failure, recovery shall be initiated automatically by switching to redundant equipment or circuits. The recovery time shall be within limits specified by 3.7.2.3, Redundancy. In the event of the degradation of the A/G primary communications switch, the VSCS shall provide for the automatic switchover to the A/G backup switch as defined in 3.5.2, Switching and control functional requirements, and in accordance with 3.2.2, Performance. The maintenance position shall have the capability to initiate manual recovery procedures to maintain system performance by reconfiguring the system around the problem areas. Failures shall be reported, and recovery options shall be selectable.

3.5.3.2.3.1.1 Functional Recovery - After position failure recovery without an intervening position-level reconfiguration of that position, the position equipment shall return to the current operational configuration. After failure recovery, electronic patch panels shall return to the current operational configuration.

3.5.3.2.3.1.2 Voice Path Recovery - Sufficient voice paths shall be provided to meet the availability requirements of the communications functions.

3.5.3.2.3.2 Diagnostic Control - The maintenance position shall have the capability to initiate diagnostic testing for failure isolation. The maintenance position shall have the capability to establish any connection that can be provided to operational positions.

3.5.3.2.3.3 Reporting Selection Control - The maintenance position shall have the capability to select real-time status reports on tests. The status

area of supervision within 1 second of failure detection.

3.5.3.2.2.1.4 Reports to ACCC - Health status reports, failure, and recovery notifications shall be routed to the ACCC in accordance with the VSCS-ACCC IRD (see 3.6.3).

3.5.3.2.2.1.5 Reports to NMCE - Trunk status reports, failure, and recovery notifications shall be routed to the NMCE in accordance with the VSCS-NMCE IRD (see 3.6.13).

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3.5.3.2.3.3 Reporting Selection Control - The maintenance position shall have the capability to select real-time status reports on tests. The status

terminal and, when in use, shall not restrict the maintenance position capabilities.

3.5.4 System Management Functions

3.5.4.1 Reconfiguration - The control function shall provide the capability to reconfigure the operational features and communications assignments of all positions within a facility.

3.5.4.1.1 Characteristics - For reconfiguration purposes, the hardware configuration can be described in terms of the number and identity of positions within a facility: the type, identity, and number of trunks; and the configuration of the RCE or existing radio interfaces, and BUEC resources. The operational configuration, as used here, is described as the assignment of communications and functional capabilities using the trunks, the RCE or existing radio interfaces, and the BUEC, to each operational position within a facility. Reconfiguration shall provide for the reassignment of communications and functional capabilities and ensure the connectivities required to implement the assignments.

3.5.4.1.1.1 Configuration - A facility will have configurations mapped out to operate under different sets of conditions. Configurations shall be comprised of physical maps defining the hardware configurations of a facility, facility configuration maps defining the communications and functional assignments of all positions within a facility, and switch maps defining the desired connectivity for the switching hardware. Position configuration maps define the logical communications assignments and classmarks restricting communications and functional capabilities for operational positions. Sector configuration maps are the logical groupings of position configuration maps. Area configuration maps are the logical groupings of position and sector configuration maps. Facility configuration maps are the logical groupings of position, sector, and area configuration maps.

**3.5.4.1.1.1.1** Physical Maps - Physical configuration maps define the hardware configuration of a facility. The physical configuration of a facility changes only as a result of automatic equipment switchover due to hardware failure, in response to reconfiguration commands, and as a result of updates to the RCE site adaptation data. The VSCS obtains RCE site adaptation data from the RCE, as specified in the VSCS-RCE IRD. The existing radio interfaces do not provide site adaptation data.

**3.5.4.1.1.1.1.1** Service Classmarks - Classmarks assigning or restricting classes of service for trunk circuits and RCE or existing radio interfaces shall be defined in physical configuration maps.

3.5.4.1.1.1.1.2 Physical Characteristics - Facility characteristics defined in physical maps shall include, at a minimum, the following:

a. Interfacility trunk ports.
b. PABX trunk ports.
c. RCE or existing radio interface configuration resources.
d. BUEC system configuration resources.

e. Position ports.

3.5.4.1.1.1.2 Position Maps - Position configuration maps define the logical communications assignments and classmarks restricting communications and functional capabilities for operational positions. The capability shall be provided to logically group position configuration maps by sector, area, and facility configurations.

3.5.4.1.1.1.2.1 Operational Classmarks - Classmarks restricting communications and functional capabilities are defined in position configuration maps. Classmarks shall include, at a minimum, those listed in Table XIII.

Table XIII. Classmarks

For an operational position:

- A/G capabilities and displays
- Reconfiguration initiation authorization
- Data access authorization ,
- Alarm/alert reporting
- Access to operational reports

For A/G communication capabilities:

- Selective/split operations
- Transmitter/receiver site selection
- Frequency cross-coupling
- BUEC access
- M/S transmitter selection
- M/S receiver selection
- Remote receiver muting
- PTT preemption
- Weather recording broadcast

For G/G communications capabilities:

- DA call override
- IA call override
- Conference call initiation
- Position voice monitoring
- Position voice monitor recording
- PTT for G/G communications
- Access to and from PABX, FTS, and PSTN
- Latching/nonlatching type of call activation

Table XIII. Classmarks

For an operational position:

- A/G capabilities and displays
- Reconfiguration initiation authorization
- Data access authorization ,
- Alarm/alert reporting
- Access to operational reports

For A/G communication capabilities:

- Selective/split operations
- Transmitter/receiver site selection
- Frequency cross-coupling
- BUEC access
- M/S transmitter selection
- M/S receiver selection
- Remote receiver muting
- PTT preemption
- Weather recording broadcast

For G/G communications capabilities:

- DA call override
- IA call override
- Conference call initiation
- Position voice monitoring
- Position voice monitor recording
- PTT for G/G communications
- Access to and from PABX, FTS, and PSTN
- Latching/nonlatching type of call activation

reconfiguration shall be provided to support sector roll-in and sector roll-out. Sector roll-in is the combining of sector communication capabilities at a sector position; sector roll-out is the distributing of communications capabilities among the sector positions.

3.5.4.1.1.3.3 Area-level Reconfiguration - Area-level reconfiguration shall be provided to support combining and decombining of individual sector communications capabilities. Usually two or three adjoining sectors are combined into a single larger sector and controlled from a single sector suite during light traffic periods. This larger sector is then decombined to individual sector suites during busy periods.

3.5.4.1.1.3.4 Facility-level Reconfiguration - Reconfiguration on a facility level shall be provided to support a shift change affecting more than one area within a facility. Facility-level reconfiguration shall also be provided to support the combining and decombining of sectors over area boundaries, system initialization, and facility backup. Facility backup will be achieved by expanding the airspace controlled by facilities surrounding a failed facility. Facility-level reconfiguration shall also support the entire resectorization of airspace, establishment of new airways, and the creation of new sectors.

3.5.4.1.1.4 Timing Performance - Reconfiguration timing performance shall be as specified in 3.2.2.4.

3.5.4.1.2 Reconfiguration Initiation - The VSCS shall accept reconfiguration commands for all levels of reconfiguration via the AAS. Prior to the introduction of the AAS, reconfiguration commands shall be accepted directly from the area manager, authorized supervisory positions, and the maintenance position via the display function.

3.5.4.1.2.1 Reconfiguration Initiation by AAS - The VSCS shall accept, through the AAS, facility-level reconfiguration commands initiated from the area manager and facility, area, sector, and position-level reconfiguration commands from authorized supervisory positions, as classmarked. These commands are routed via the AAS computer in accordance with the data interchange defined in the VSCS-ACCC IRD (see 3.6.3).

3.5.4.1.2.2 Reconfiguration Initiation by Supervisory Positions - Prior to the introduction of the full AAS, and, after the full AAS is installed, as a backup to the VSCS-ACCC interface, authorized supervisory positions shall be provided the capability of initiating facility-level reconfigurations and area, sector, and position-level reconfigurations defined within an established facility configuration and within the areas of their supervision. This capability is defined and restricted by classmark in the configuration maps defined for supervisory positions. The reconfiguration options shall be displayed to the supervisory position, and the capability shall be provided for selection of the desired reconfiguration.

3.5.4.1.2.3 Reconfiguration Initiation by Maintenance Position - The maintenance position shall be provided the capability to initiate the

reconfiguration of trunk circuits and position-level reconfiguration, as classmarked. The available options shall be displayed to the maintenance position. The capability shall be provided for selection of the desired reconfiguration.

3.5.4.1.2.4 Priority of Reconfiguration Commands - A facility-level reconfiguration command shall have priority over any lower level area, sector, or position-level reconfiguration command. Area, sector, and position-level reconfigurations shall be provided within an established facility configuration. The priority in processing reconfiguration commands shall be for commands initiated by the area manager, by supervisory positions, and then by the maintenance position. A reconfiguration in progress shall not be interrupted by a subsequent reconfiguration command.

3.5.4.1.2.5 Initiation Commands - Prior to the introduction of the AAS, the VSCS shall receive commands, directly from the area manager, authorized area supervisory positions, and the maintenance position. Reconfiguration initiation command inputs shall include at least the identification of the logical map to be implemented.

3.5.4.1.3 Operational Sequence - Prior to implementation of a reconfiguration, the authority, as classmarked, of the position requesting the reconfiguration shall be validated. Upon validating the reconfiguration command, the required maps shall be identified in the configuration database and made available to the display and switching functions for implementation. Execution of reconfiguration shall not in any way interrupt or disturb calls in progress or lose incoming communications. An indication of reconfiguration completion shall be provided to all positions being reconfigured.

3.5.4.1.3.1 Simultaneous Reconfigurations - The capability shall be provided for simultaneous execution of nonoverlapping position-, sector-, and area-level reconfigurations. Simultaneous reconfigurations shall not reconfigure the same positions.

3.5.4.1.3.2 A/G Backup Switch Reconfiguration - The A/G backup switch capability as specified in 3.5.2.1.4 shall be provided the current A/G configuration as implemented.

3.5.4.1.4 Monitor and Control - Upon receiving a reconfiguration initiation command, the reconfiguration operational sequence shall be controlled and monitored. The control function shall accept status and acknowledgments from the display and switching functions as to the progress of their respective reconfigurations. The display and switching functions shall acknowledge reconfiguration initiation. Execution shall be in accordance with 3.2.2.4, Reconfiguration timing requirements, or shall follow completion of any calls in progress, at which time completion status shall be provided. Reconfiguration status and acknowledgments shall be reported to the ACCC in accordance with the data interchange defined in 3.6.3. The initiation and completion of the reconfiguration process shall be reported to

reconfiguration of trunk circuits and position-level reconfiguration, as classmarked. The available options shall be displayed to the maintenance position. The capability shall be provided for selection of the desired reconfiguration.

3.5.4.1.2.4 Priority of Reconfiguration Commands - A facility-level reconfiguration command shall have priority over any lower level area, sector, or position-level reconfiguration command. Area, sector, and position-level reconfigurations shall be provided within an established facility configuration. The priority in processing reconfiguration commands shall be for commands initiated by the area manager, by supervisory positions, and then by the maintenance position. A reconfiguration in progress shall not be interrupted by a subsequent reconfiguration command.

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3.5.4.1.3.1 Simultaneous Reconfigurations - The capability shall be provided for simultaneous execution of nonoverlapping position-, sector-, and area-level reconfigurations. Simultaneous reconfigurations shall not reconfigure the same positions.

3.5.4.1.3.2 A/G Backup Switch Reconfiguration - The A/G backup switch capability as specified in 3.5.2.1.4 shall be provided the current A/G configuration as implemented.

3.5.4.1.4 Monitor and Control - Upon receiving a reconfiguration initiation command, the reconfiguration operational sequence shall be controlled and monitored. The control function shall accept status and acknowledgments from the display and switching functions as to the progress of their respective reconfigurations. The display and switching functions shall acknowledge reconfiguration initiation. Execution shall be in accordance with 3.2.2.4, Reconfiguration timing requirements, or shall follow completion of any calls in progress, at which time completion status shall be provided. Reconfiguration status and acknowledgments shall be reported to the ACCC in accordance with the data interchange defined in 3.6.3. The initiation and completion of the reconfiguration process shall be reported to

maps into the database shall be provided.

3.5.4.1.5.4 Map Modification - The capability to modify existing configuration maps off-line shall be provided. The capability shall be provided to extract, replace, add, delete, copy, and modify any map or part of a map within a configuration database.

3.5.4.1.5.5 Map Validation - Maps shall be interactively validated to ensure that under each configuration the connectivities for each position are achievable. Validation procedures shall also be provided for maps already included in a database.

3.5.4.1.5.6 Database Utilities - Utilities to maintain the configuration database shall include at least the following functional capabilities:

a. Database creation and deletion.

b. Map creation and deletion.

c. Update of maps.

d. Journaling: maintaining a log of all changes made to a database to support long- and short-term recovery procedures.

e. Long- and short-term recovery procedures to recover a corrupted database in event of user error or hardware or software failure.

f. Database utilization and timing monitoring utilities with interactive capabilities as well as capabilities to output to a file for later analysis.

g. Data definition language.

h. Data manipulation language.

i. Database integrity verification utility.

j. Database lock mechanism.

k. Database security mechanisms.

1. Database backup utility.

m. Database compression utility.

3.5.4.1.5.7 Database Access - A designated position shall have the capability to create, modify, and validate the configuration database. The capability shall be provided to control and access all database utilities. The capability shall be provided to download the configuration database and configuration maps to the operational VSCS and to back up the operational configuration database and configuration maps to the off-line system.

3.5.4.1.6 Recovery Processes - In the event of failure detection by the monitoring function during the reconfiguration process, recovery shall be initiated' automatically, when possible, or initiated through manual procedures. The recovery procedures shall be in accordance with the recovery procedures as described in 3.5.3, Supervisory and maintenance requirements.

3.5.4.1.6.1 Automatic Recovery - Recovery from a failure of an element used by the reconfiguration process shall be automatic when a redundant element is available. The reconfiguration process shall be automatically retried three times from the last logical step successfully completed, and shall then be flagged for manual recovery.

3.5.4.1.6.2 Manual Recovery - The capability to employ manual recovery methods shall be provided to'recover from any failure of the reconfiguration process. Recovery shall automatically reestablish the previous operational configuration. Manual recovery capabilities shall include, at least, the following:

a. Canceling a reconfiguration request prior to completion.

b. Canceling a logical area reconfiguration within a facility reconfiguration request.

c. Canceling a logical sector reconfiguration within an area reconfiguration.

d. Canceling a logical position reconfiguration.

e. Retry of a canceled reconfiguration after failure correction.

3.5.4.2 Traffic Data Collection, Reduction, and Analysis - The VSCS shall have the capability to collect, reduce, and analyze communications traffic data. Communications traffic data collection, reduction, and analysis shall not interfere with and shall not degrade the performance-or throughput of any VSCS communications processing.

3.5.4.2.1 Traffic Data - Communications traffic information shall include A/G communications functions, G/G communications functions, reconfiguration status, and time-of-day reset. Traffic data shall be formatted data records, using data coding as approved by the FAA, containing, at a minimum, GMT and communication traffic information with a time-stamp accurate to within .01 second of the occurrence of the recorded event.

3.5.4.2.2 Traffic Data Collection - The VSCS shall have the capability to collect traffic data on a continuous basis.

3.5.4.2.2.1 Voice Communications Traffic Data Collection - Voice communications traffic data shall include, at a minimum, information on position incoming and outgoing communications, on position call initiations

and terminations, on call processing times, on position relief briefing; on call types such as DA, IA, IC, IP, OVR, voice calls, conference calls, trunk calls, A/G calls, and PTT, and weather message broadcasting.

3.5.4.2.2.2 Other Communications Traffic 'data Collection - Other communications support functions shall be available for traffic data collection. These functions shall include, at a minimum, selection of M/S for transmitters/receivers, activation/deactivation of BUEC for a frequency, reconfiguration processing time, activation of special call features such as IA OVR, CA queue call selection, and the activation of special call functions such as monitoring, call forwarding, and call transfer.

3.5.4.2.3 Traffic Data Reduction - A capability shall be provided to reduce traffic data by combining traffic data records to create a new data record, as specified in 3.5.4.5, Support processing. The VSCS shall have the capability to prepare traffic data for analysis with functions that include, as a minimum:

a. Traffic data integrity checks.
b. Screening of data.
c. Extraction of detail for analysis.

3.5.4.2.3.1 Traffic Data Integrity Checks - Capabilities shall be provided to define minimum and maximum limits and to define standard deviation limits 'to be calculated to determine valid data. This capability shall include providing data exception reports identifying data that are not valid.

3.5.4.2.3.2 Screening of Data - Capabilities shall be provided to identify and remove data not considered valid or data outliers from the data to be used for a specific analysis.

3.5.4.2.3.3 Extraction of Detail for Analysis - A capability shall be provided to identify and to select categories of data for analysis. A capability shall be provided to save selected reduced and screened data into a data file for subsequent analyses.

3.5.4.2.4 Analysis Requirements - The VSCS shall provide the capability to conduct statistical evaluation of the traffic data collected and reduced. The VSCS shall provide the capability to automatically activate periodic and on-request analyses at specified days, dates, and times (See Appendix I, paragraph 10.5).

3.5.4.2.4.1 Statistical Evaluation - Statistical evaluation of traffic data shall include the capabilities to select the data to be analyzed and to select the type of analysis to be performed. Data selection shall include the capability to specify subgroups within the data file to access. Types of analyses shall include data summaries such as univariate descriptive statistics; correlations, histograms, and scatter plots, and data analyses such as analysis of variance, regression analysis, and trend analysis.

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3. Distribution of reconfiguration times.
4. Occurrence of calls in progress during reconfiguration.

3.5.4.2.4.3 System Response - Traffic data analyses shall be performed with results available within 4 hours for' data collected in last 24 hours.

3.5.4.2.5 Data Transfer - The VSCS communications traffic information collected shall be transferred to mass storage. Mass storage shall be capable of saving, at a'minimum, all data collected during 1 day. Data that is to be transferred to mass storage shall be validated prior to the transfer. Controls shall be provided to prevent loss of data before, during, and after data transfer.

3.5.4.2.5.1 Data to Tape - A classmarked position shall have the capability of initiating and terminating VSCS communications traffic information collection to magnetic tape. The classmarked position shall have the capability to collect traffic information on all or selected groups of traffic information.

3.5.4.3 System Startup - The control function shall manage the orderly startup of the VSCS. Diagnostics shall be requested from all functional areas on system startup and reported as required. The RCE site adaptation data shall be requested from the RCE. The facility configuration map identified during startup procedures shall be implemented. The configuration data base and operational programs shall be downloaded. The design goal for a VSCS startup, including power up and configuration of positions, shall be no more than 30 minutes.

3.5.4.3.1 Warm Start - Warm start of the VSCS shall be provided. The current configuration of the operational system shall be recorded and that record updated. In the event of hardware or software failure, the operational program shall be restarted without reloading the configuration database, reloading the RCE site adaptation data, or losing the current selections at any operational position.

3.5.4.4 Timing and Synchronization - The VSCS shall provide for time-of-day reference for administrative purposes. It shall also contain provisions for accepting system timing and synchronization from the master network source.

3.5.4.4.1 Time of Day - The VSCS shall provide a time-of-day reference that shall be capable of maintaining year, month, day, hour, minute, and second. The VSCS internal/external synchronization circuit shall permit syncronization within 1 ms. of an external time source. The VSCS shall provide for the manual entry of the time of day. The format shall be as described in the CTS/User Systems IRD (3.6.10).

3.5.4.4.1.1 Reset of Time of Day - The VSCS shall provide a capability to

manually reset the time of day. The VSCS shall provide the capability to automatically reset the time of day to conform to the external time source.

**3.5.4.4.2** System Timing and Synchronization - The VSCS shall be capable of interfacing and synchronizing with external digital voice networks to support synchronized digital communication.

3.5.4.4.2.1 Clock Stability - The VSCS shall provide a clock with a long-term, free-running drift rate of no more than one part in 10 to the tenth power per day.

3.5.4.5 Support Processing - A capability shall be provided so that startup or failure of support processing hardware or software shall not cause a loss of on-line VSCS functions and shall not degrade the on-line VSCS activity. Support processing capability shall be provided to perform those functions that need not be performed on-line in real time. Any of the support functions may be performed in the background mode, with FAA approval, providing sufficient capacity is available and that it can be demonstrated that such functions shall not have an effect on VSCS on-line throughput.

3.5.4.5.1 Interface to On-Line System - In the event support processor(s) are used, a high-speed interface of at least 1.5 megabits per second shall be provided to support the downloading from the support processor to the on-line processors of the configuration database and the operational program and remote booting capabilities for on-line processors.

3.5.4.5.2 Functional Description - Use of support processors shall not require knowledge of the internal retrieval and storage mechanisms and other technical aspects of the system. Display formats shall be designed to provide optimum transfer of informatibn to the user, and data shall be presented to the operator in a readily usable and readable format. Support processors shall be provided to support at least the following functional requirements:

a. Reconfiguration database management.
b. 'Traffic data reduction and analysis. .
c. RTQC data formatting and reporting.
d. VSCS operational program startup.
e. Changes to operating system and software.

3.5.4.5.2.1 Reconfiguration Database Management - Support command procedures, programs, and processors shall be provided to aid in creating and managing the database required for the reconfiguration process. These processors shall function as an interface to the database management system. Processors shall be provided to support at least the following functional requirements:

a. Screen formatting control.
b. Database access.
c. Map validation.

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## 3.6 INTERFACES

### 3.6.1 General

This section provides a list of the external interfaces of the VSCS, which is also a directory of the pertinent Interface Requirements Documents (IRDs).

### 3.6.2 VSCS-ACCC (Common Console)

The physical'and electrical interfaces between the VSCS and the ACCC shall be as described in the VSCS-ACCC (Common Console) IRD.

### 3.6.3 VSCS-ACCC

The Advanced Automation System (AAS) will be responsible for controlling the configuration of the facility. The AAS will send commands to the VSCS to manage the configuration of the voice communications equipment. The interface between the VSCS and the AAS shall be as described in the VSCS-ACCC IRD.

### 3.6.4 VSCS-MPS

The interface between the VSCS and the Maintenance Processor System (MPS) shall pass information regarding the status of VSCS hardware and software modules, external interfaces (Trunk, Radio, and BUEC), and air traffic controller positions. The interface between the VSCS and the MPS shall be as described in the VSCS-MPS IRD.

### 3.6.5 VSCS-RCE

Radio control equipment (RCE) will provide interconnecting paths between the VSCS and the A/G radio transmitters and receivers. There will be an electrical/electronic interface module for each transmitter/receiver channel, and an interprocessor interface to the maintenance data link between the VSCS and RCE processors. The interface between the VSCS and the RCE shall be as described in the VSCS-RCE IRD.

### 3.6.6 VSCS-BUEC

This interface shall provide an A/G voice communication path into the Backup Emergency Communication (BUEC) radio equipment. The interface between the VSCS and BUEC shall be as described in the VSCS-BUEC IRD.

### 3.6.7 VSCS-PABX

The interface between the VSCS and the Private Automatic.Branch Exchange (PABX) shall handle access to PSTN and FTS. The VSCS-PABX interface shall be as described in the VSCS-PABX IRD.

3.6.8 VSCS-Trunks

VSCS interfaces to trunks shall be governed by the VSCS-Trunks IRD.

3.6.9 VSCS-REC

The Recording System (REC) provides tape recording facilities that make a legal record of all ATC voice communications. The interface between the VSCS and REC shall be as described in the VSCS-REC IRD.

3.6.10 VSCS-CTS

The VSCS needs timing information to synchronize its operations with those of the rest of the facility, and to time-stamp messages and records that the VSCS sends out. The External Time Source (XTS) shall use a Digital Clock unit to provide time signals for VSCS use. The interface between VSCS and XTS shall be as described in the CTS/User Systems IRD.

3.6.11 VSCS-Weather

Weather and forecast information shall be transmitted to aircraft as needed. The interface between the VSCS and the weather source shall be as described in the VSCS-Weather IRD.

3.6.12 RESERVED

3.6.13 VSCS-NMCE

The VSCS shall be designed to interface with the Monitor and Control Equipment (NMCE) in accordance with the VSCS-NMCE IRD.

3.6.14 VSCS-Power

The VSCS shall be capable of drawing power either from FAA's power conditioning system (PCS) or from commercial ac line power according to operating environment. The power connection shall be in accordance with the VSCS-Power IRD.

3.6.15 VSCS-Existing Radio Interfaces

In the absence of the RCE, the existing radio interfaces will provide interconnecting paths between the VSCS and the A/G radio transmitters and receivers. The interface between the VSCS and the existing radio interfaces shall be as described in the VSCS - Existing Radio Interfaces ICD.

3.6.16 RESERVED

3.6.8 VSCS-Trunks

VSCS interfaces to trunks shall be governed by the VSCS-Trunks IRD.

3.6.9 VSCS-REC

The Recording System (REC) provides tape recording facilities that make a legal record of all ATC voice communications. The interface between the VSCS and REC shall be as described in the VSCS-REC IRD.

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3.6.12 RESERVED

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The VSCS shall be capable of drawing power either from FAA's power conditioning system (PCS) or from commercial ac line power according to operating environment. The power connection shall be in accordance with the VSCS-Power IRD.

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In the absence of the RCE, the existing radio interfaces will provide interconnecting paths between the VSCS and the A/G radio transmitters and receivers. The interface between the VSCS and the existing radio interfaces shall be as described in the VSCS - Existing Radio Interfaces ICD.

3.6.16 RESERVED

## 3.7 SYSTEM RELIABILITY AND MAINTAINABILITY REQUIREMENTS

This section defines and describes design requirements that shall be achieved and elements that shall be implemented for the VSCS RMA program. The Preliminary RMA Program Plan shall contain elements for a reliability program and a maintainability program.

### 3.7.1 Definitions

The RMA terms are defined in Appendix I and MIL-STD-721.

### 3.7.2 Reliability

3.7.2.1 Single-point Failure - The VSCS shall be designed not to permit single-point failures that impede the accomplishment of system objectives as defined by this system specification.

3.7.2.2 Secondary Failure - The VSCS shall be designed not to permit the propagation of primary failures to other devices, components, or assemblies.

3.7.2.3 Redundancy - When redundant elements are used in the VSCS to meet the specified availability requirements, they shall be switched on-line without degradation of system performance. Automatic switching time shall not exceed 50 ms to restore a given position function, 100 ms to restore an operable S/S, and 10 seconds to restore an operable facility. The loss of A/G function for more than 100 ms shall be acknowledged by loss of side tone and flutter. When manual redundancy switching is required, the time to switch in redundant elements shall take no more than automatic switching time to restore operability, independent of manual diagnostic time.

3.7.2.4 Reliability Program - The reliability program for the VSCS has as its objective the efficient and effective use of programmatic tools in the achievement of RMA requirements. To this end, the reliability program shall use MIL-STD-785 in the tailoring of program elements to the VSCS. The time phasing of these reliability program elements shall be developed in accordance with the VSCS Program life cycle; e.g., all program milestones shall be reflected in the reliability task phasing. The RMA inputs and outputs that contribute to the achievement of these milestones shall be clearly identified.

### 3.7.3 Maintainability

3.7.3.1 Maintenance Concept - The maintenance concept for this program shall be consistent with the FAA maintenance program described in the VSCS Integrated Logistics Support Plan.

3.7.3.2 Preventive Maintenance (PM) - Any PM that causes a failure to any function or functionality being used in operations shall be counted as

I corrective maintenance. The design goal for the VSCS shall be directed toward no system interrupting PM. All PM will be limited to lowest traffic intensity pariods. Mean time between preventive maintenance actions (MTBPMA) for any item shall not be less than 90 days.

3.7.3.3 Mean Time to Repair (MTTR) - Equipment MTTR shall not exceed 30 minutes for corrective maintenance, subject to maintainability analyses and demonstration. The final allocated MTTR shall be determined for each self-contained functional unit in terms of bring the system back to being fully functional with redundancy. The mean bench repair time (MBRT) for VSCS LRUs shall not exceed 4 hours. Support equipment MTTR shall not exceed 60 minutes for corrective maintenance, subject to maintainability analysis and demonstration.

3.7.3.4 Maintenance Requirements - For all VSCS equipment, the quantitative maintainability requirements shall be based on the removal and replacement of modules, using system-specialist-level maintenance technicians. In this regard, a module shall be a LRU, such as a printed circuit assembly or equipment. The system shall be designed for rapid fault isolation through the designated use of automatic on-line fault isolation, BITE, and BIT capability. The system design shall have as a requirement on-line fault-isolation capability to one or two modules in 95% of all failures, and to one module in 85% of all failures.

3.7.3.5 Service and Access - For all VSCS equipment, design for ease of servicing and access shall be in accordance with 5.9, 5.10, 5.11, and 5.13 of MIL-STD-1472. All modules and equipment shall be completely removable from their enclosure without excessive disassembly. All test points shall be accessible without disassembly of the equipment. The equipment shall be designed to permit modular replacement without removal of adjacent modules. Calibrations and adjustments shall be accomplished through the use of either built-in meters and gages, or with portable test instruments. When safety allows, access shall be provided to modules from outside the basic equipment through the use of swing-out units, pull-out drawers with drawer slides, cable extenders, and cable retractors. The variety and number of special tools and test equipment required to maintain the equipment shall be held to a minimum.

3.7.3.6 Test Points - For all VSCS equipment, test points and facilities for interconnecting test equipment shall be provided for determining the performance quality of the equipment. Test points shall be in accordance with MIL-STD-415.

3.7.3.7 Modules - All equipment shall be designed to use modular construction, and the number of unique module types shall be kept to a minimum. All modules shall be plug-in type modules where practicable, and shall have positive locking mechanisms to prevent loosening. Plug-in modules shall be standardized to permit interchangeability of like modules without alignment or adjustment. All modules shall be keyed to prevent incorrect installation. Splitting of single functions across more than one module shall be avoided.

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## 3.8 CERTIFICATION

### 3.8.1 Plan

The system, function, and equipment certification for the VSCS shall be in accordance with the Maintenance Plan.

3.8.1.1 Automatic Verification - Automatic verification routines shall be provided within the VSCS to verify lower level functionality. Initiation of all verification routines may be performed manually, and maintenance personnel may interrupt any automatic verification routines. Results from these routines shall be directed to the maintenance person via the VSCS maintenance position or the MPS position. All results presented to the maintenance person shall provide the complete basis necessary for certification of system functionality.

### 3.8.2 BIT/BITE

BIT capability is the collection of functions that allow selective testing of the functionality containing the BIT or of a closely related functionality. BITE is one form of BIT in which the test functions are resident in a set of dedicated circuits contained within, but not a part of, the functionality to be tested. The other predominant form of BIT is usually software and is associated with the system as a whole or is part of a processor within the system.

3.8.2.1 BIT/BITE Functions - Whichever form BIT/BITE takes, it shall function within the VSCS environment to: (a) permit detection and isolation of malfunctions down to the LRU, and (b) to permit certification, from full system, to the LRU level, that a VSCS functionality, which may contain a repaired or replaced LRU, is performing properly.

### 3.8.3 Applicability

Certification shall be required in the following cases:

a. Verification of proper functional operation upon completion of necessary repairs.

b. Verification of the readiness of equipment not in service to be activated by reconfiguration activities.

c. Daily verification of system performance.

### 3.8.4 Methodology

Certification in the VSCS environment is the use of BIT/BITE to determine the readiness of a VSCS functionality to perform its specified functions. All BIT/BITE will be transparent to operational use, except for controller-initiated functional path verifications. BIT/BITE shall have adequate capability to determine this readiness to a confidence of 99%.

This means that in 99 out of 100 attempts to determine readiness, it is expected that at least 99 will give affirmative results when this is the true state of the system. When a specific functionality, by virtue of its critical importance, requires a higher degree of confidence, added testing shall be used at any operational console on a non-interference basis. This testing shall be accomplished using portable and/or centralized test diagnostics and shall be applied, as follows:

a. Digital signal paths shall be verified by inserting appropriately structured bit streams or test words and comparing the outputs with expected values.

b. Pulse-coded signal paths shall be verified by inserting appropriate analog signals, covering the frequency range of the path being tested, in a position ahead of the pulse-code circuitry, and comparing coded outputs with expected values. The analog signals shall have at least the highest and the lowest frequencies to be passed included in seven frequency intervals represented in the test signals. The distortion shall be tested by using filters to separate fundamentals and using the residuals as a test value.

c. Analog signal paths shall be verified by inserting appropriate analog signals, covering the frequency range of the circuit, and comparing outputs to expected values. The analog signals shall have at least the highest and the lowest frequencies to be passed represented in the test signals. This shall help to verify that the frequency response requirements for frequencies between 300Hz and 3000Hz are in accordance with 3.2.2.6.6. The distortion shall be tested by using filters to separate fundamentals and using the residuals as a test value.

## 3.9 SYSTEM DESIGN ANQ CONSTRUCTION

The VSCS shall be designed and constructed so that all specified modularity, performance, and RMA requirements shall be achieved throughout the specified service life. Construction of the system equipment shall employ standardization of cabinets, modules, printed circuit assemblies, components, materials, processes, and workmanship.

### 3.9.1 Interchangeability

Mechanical and electrical interchangeability shall exist among all assemblies, subassemblies, and replaceable parts that are intended to be identical regardless of manufacturer or supplier (see MIL-STD-454, Requirement 7).

### 3.9.2 Dissimilar Metals

Dissimilar metals shall not be used where they will degrade or cause deterioration to the assembled parts. When dissimilar metals are used, they shall be coated or protected to inhibit or prevent degradation to other parts and assemblies.

### 3.9.3 Service Life

The equipment shall be designed and constructed to have a service life of at least 20 years with the maintenance principles specified in 3.7. During its service life, the VSCS shall operate continuously 24 hours per day.

### 3.9.4 Mechanical Requirements

3.9.4.1 Equipment Layout - All equipment shall be in accordance with the ground workspace design requirements of MIL-STD-1472, 5.7.1. Removable doors, if used, shall be designed to prevent contact with equipment while being removed or replaced. The equipment layout shall be accommodated within the equipment room space designated in 3.9.4.1.1, Equipment room floor space.

3.9.4.1.1 Equipment Room Floor Space - The equ'i'pment room floor space required for a maximum sized VSCS, in accordance with sizing data, shall be within an area of 34 ft. by 56 ft. This area has four columns located 21 ft. on.center. There will also be an ajoining area of 10 ft. by 18 ft.

3.9.4.1.2 Workshop and Storage Area Floor Space - All site level storage and workshop equipment necessary to support the VSCS shall be accommodated within an area of 15 ft (4.57 m) by 30 ft (9.14 m).

3.9.4.2 Module Removal and Insertion Damage - All equipment shall be designed for removal and insertion of modules and printed circuit assemblies without causing damage to the modules and printed circuit assemblies or to any equipment external to the module or printed circuit assemblies. Each

module (LRU) shall be capable of being removed or inserted while power is on, or shall have keyed elements or interlocks to disable power to that LRU during removal or insertion. Plug-in modules and assemblies shall be designed to prevent insertion or connection when incorrectly oriented.

3.9.4.3 Printed Circuit Assemblies - Printed circuit assemblies shall comply with the requirements of MIL-STD-275. Terminology and definitions shall be in accordance with ANSI/IPC-T-50. Screwdriver adjustments required for alignment shall be located at the printed board edge.

3.9.4.4 Cabinet and Frame Construction - The equipment room cabinets and frames shall not exceed a height of 72 in. (1.83 m), a width of 36 in. (0.91 m), and a depth of 30 in. (0.76 m). The loading conditions of each fully equipped cabinet and frame shall not exceed 125 lb/sq ft. The maximum weight of a single empty cabinet or frame shall not exceed 200 lb. The structural strength and rigidity of the cabinets, consoles, and frames shall be such that normal handling in loading, shipping, unloading, and setting into position for installation will not result in any damage to the equipment. Removal of equipment or modules or interchanging of equipment or modules shall not cause any deformation to the cabinets or frames. Structural strength and rigidity of all cabinets shall be independent of any strength or rigidity provided by access doors. Equipment cabinets shall have removable tops and sides and shall have doors on the front and back. Removable components shall not exceed a maximum weight of 50 lb to permit removal and replacement by one person with the exception of power supply modules and storage media drives. Removable equipment cabinet or frame-lifting devices (hooks, rings, etc.) may be installed for convenience to facilitate handling and installation.

3.9.4.4.1 Cabinets and Frame Prewiring - All equipment cabinets and frames shall be prewired to minimize on-site expansion wiring and cabling. Cabinet and frame prewiring shall be complete even though the number of cabinets or frames used to satisfy the capacity requirements specified at each site may not include a full complement of equipment or modules. Wiring and cabling accommodations shall be provided to interconnect future cabinets and frames that may be needed for site expansion (see Table I). All cables, wires, and harnesses shall be protected against chafing. Such protection shall be independent of the individual wire or cable insulation or jacket. Cable access shall enter and exit from the bottom of the cabinet or frame. Grounding shall be in accordance with 3.9.14.

3.9.4.4.1.1 Existing On-site Console and Frame Expandability - Existing consoles and frames in which VSCS equipment is to be installed shall be fully wired to accept all modules required.

3.9.4.4.2 Cabinet and Frame Convenience Outlets - The VSCS shall provide ac convenience outlets for cabinets and frames. The ac convenience outlets shall be independent of the primary power source for the equipment within the cabinets and frame, and in accordance with 3.3.2.1.7 of FAA-G-2100.

3.9.4.4.3 Cable Entrance and Exit - Cabinet or frame interconnecting cables shall normally enter and exit through a raised floor. Direct cabling through the sidewall of cabinets, at least 6 in. above the floor, may be used within a subsystem where distance is considered a critical factor in circuit performance. Direct cabling shall not in any way compromise the requirements of expandability.

3.9.4.5. Distribution Frames - A (contractor) distribution frame (IDF) shall be provided to facilitate the interconnection of all VSCS cables to the FAA equipment distribution frame(s). The IDF shall accomodate all VSCS interface requirements including the existing equipment-to VSCS transition switch. Cables shall be provided to interconnect the IDF to the FAA equipment distribution frame(s). The IDF shall be provided with blocks that allow incoming cables to be terminated on quick-connect terminals._ All blocks shall have quick-connect terminals that allow both equipment an cross-connect wires to be terminated. The IDF shall be capable of accommodating at least 25% more connections than required for the capacitiy specified for each site.

3.9.4.5.1 Distribution Frame Cabling - All cables, cross-connects, and cable trays shall be provided between the following entities: VSCS back room equipment and VCE; VSCS an the Contractor provided IDF; Contractor provided IDF and the FAA provided equipment distribution frame(s); VSCS and the transition switch.

3.9.4.5.2 Test and Measurement Access and **Isolation** - Access to and isolation of lines and equipment for monitoring, test, and measurement purposes shall be provided. Appropriate test points shall be provided in accordance with 3.7.3.

3.9.4.6 Protector Frames - Protector frames shall be provided as required.

3.9.4.7 Lightning Protection - The VSCS design shall provide for high voltage and lightning surge protection of VSCS equipment interfacing with external transmission facilities. The design shall be in accordance with FAA-STD-020.

3.9.4.8 Acoustic Noise Levels - Acoustic noise levels generated by the assembled and peripheral equipment shall not exceed the specifications of 3.3.1 of FAA-G-2100.

3.9.4.9 Intraconnection and Interconnection Cables - All intraconnection and interconnection cables and connectors required for factory testing, equipment site installation, checkout, acceptance testing, cutover, operation, and maintenance of the VSCS, for all VSCS installations, shall be designed for Government-furnished underfloor and overhead distribution and cabling facilities. VSCS cables shall connect electronic devices and modules associated with any transmission path located in consoles and the

equipment room. All such cabling shall permit accessibility to equipment for test maintenance and replacement. After installation, all cabling shall meet grounding requirements and electromagnetic compatibility (EMC)/ conducted and radiated electromagnetic interference (EMI) requirements. Cabling and wiring shall comply with 3.5.5.25 of FAA-G-2100; National Electric Code, NFPA-70, 1984; and FAA-C-1217.

3.9.4.9.1 Cable Connectors - All cable connectors furnished on the equipment for making external connections shall be clearly identified on the plug-in side by word labels descriptive of their specific function and by the proper reference designation in accordance with 3.9 of FAA-G-2100. Cable connectors shall be mechanically keyed to prevent incorrect installation and hookup. The mating connector part (connector or plug) that is electrically engaged shall contain female contacts. All cable connectors shall have the capability to be mechanically retained in place.

3.9.4.9.2 Cable End Terminations - Signal cable end terminations shall be solderless, quick-disconnect terminal blocks and/or solderless, wire-wrap terminal blocks or connectors. Power cable end terminations shall be screw-type terminal blocks, pressure contact terminal blocks, or connectors. Where connectors are used, each connector shall be provided with 10% spare contacts. Connectors that have insert-type contacts need be loaded with only the contacts actually used plus spares.

3.9.4.9.3 House Cables - House cables connecting the console with the equipment located in the equipment room shall be terminated with female connectors at the console. These cables shall be designed for overhead and underfloor distribution. Connectors shall be provided with 10% spare contacts. Connectors that have insert-type contacts need be loaded only with contacts actually used plus spares. Connectors shall be keyed, and each cable end and its terminating socket must be clearly marked with the proper reference designations in accordance with 3.9 of FAA-G-2100.

3.9.4.9.4 Position Cables - Position cables connecting the console modules with other modules located at ATC positions shall be terminated with female connectors at the console module end of the cable. Connectors shall be provided with 10% spare contacts. Connectors with insert contacts need be loaded only with contacts actually used plus spares. Each cable end and its terminating socket must be clearly marked with the proper reference designations in accordance with 3.9 of FAA-G-2100.

3.9.4.9.5 Power Cables - All ac power cables and wiring within the VSCS shall be shielded from the voice and signaling circuits. All ac power shall be installed in accordance with National Electrical Code, NFPA-70. Cabling shall also include all junction boxes, fittings, and distribution equipment including switches and circuit breakers from the FAA power source to the VSCS primary power panel.

3.9.4.9.6 Grounding Cables - Grounding cables, wires, and buses for the ground systems specified in 3.9.14 shall comply with FAA-G-2100 and

equipment room. All such cabling shall permit accessibility to equipment for test maintenance and replacement. After installation, all cabling shall meet grounding requirements and electromagnetic compatibility (EMC)/ conducted and radiated electromagnetic interference (EMI) requirements. Cabling and wiring shall comply with 3.5.5.25 of FAA-G-2100; National Electric Code, NFPA-70, 1984; and FAA-C-1217.

3.9.4.9.1 Cable Connectors - All cable connectors furnished on the equipment for making external connections shall be clearly identified on the plug-in side by word labels descriptive of their specific function and by the proper reference designation in accordance with 3.9 of FAA-G-2100. Cable connectors shall be mechanically keyed to prevent incorrect installation and hookup. The mating connector part (connector or plug) that is electrically engaged shall contain female contacts. All cable connectors shall have the capability to be mechanically retained in place.

3.9.4.9.2 Cable End Terminations - Signal cable end terminations shall be solderless, quick-disconnect terminal blocks and/or solderless, wire-wrap terminal blocks or connectors. Power cable end terminations shall be screw-type terminal blocks, pressure contact terminal blocks, or connectors. Where connectors are used, each connector shall be provided with 10% spare contacts. Connectors that have insert-type contacts need be loaded with only the contacts actually used plus spares.

3.9.4.9.3 House Cables - House cables connecting the console with the equipment located in the equipment room shall be terminated with female connectors at the console. These cables shall be designed for overhead and underfloor distribution. Connectors shall be provided with 10% spare contacts. Connectors that have insert-type contacts need be loaded only with contacts actually used plus spares. Connectors shall be keyed, and each cable end and its terminating socket must be clearly marked with the proper reference designations in accordance with 3.9 of FAA-G-2100.

3.9.4.9.4 Position Cables - Position cables connecting the console modules with other modules located at ATC positions shall be terminated with female connectors at the console module end of the cable. Connectors shall be provided with 10% spare contacts. Connectors with insert contacts need be loaded only with contacts actually used plus spares. Each cable end and its terminating socket must be clearly marked with the proper reference designations in accordance with 3.9 of FAA-G-2100.

3.9.4.9.5 Power Cables - All ac power cables and wiring within the VSCS shall be shielded from the voice and signaling circuits. All ac power shall be installed in accordance with National Electrical Code, NFPA-70. Cabling shall also include all junction boxes, fittings, and distribution equipment including switches and circuit breakers from the FAA power source to the VSCS primary power panel.

3.9.4.9.6 Grounding Cables - Grounding cables, wires, and buses for the ground systems specified in 3.9.14 shall comply with FAA-G-2100 and

Table XIV Temperature, Humidity, and Altitude Conditions

| Condition | Ambient Temperature, Degrees Centigrade Degrees Fahrenheit | Relative Humidity, % RH | Altitude, ft (m) |
|---|---|---|---|
| Operating* | +10 to +40 (+50 to +104) | 10 to 80 | 0 to 10,000 (0 to 3,048) |
| Nonoperating | -50 to +70 (-58 to +158) | 0 to 100 (Including condensation) | 0 to 50,000 (0 to 15,240) |

*The condition is the range within which the facility air conditioning system is permitted to operate. It, therefore, represents the allowable operating heat sink condition to which the VSCS must dissipate the waste heat. A design margin range of 0 degrees C to +50 degrees C shall be included for the operating condition. See Figure 4-l.

**3.9.5.2** Vibration and Shock Design Requirements

3.9.5.2.1 Random Vibration - Random vibration design requirements are specified in Table XV. The random vibration shall be assumed in each of the three mutually orthogonal axes at the mounting of the assembly. -The design exposure time requirement is 10 minutes per axis. One axis may be assumed if substantial evidence can be given to show that there is a single axis that will reveal most of the workmanship and material faults in the VSCS equipment.

3.9.5.2.2 Shock Requirements - For shipment, proper packaging techniques shall be implemented to prevent damage from transportational vibration and shock. For unpackaged bench handling, the VSCS hardware shall withstand a 4-inch pivotal drop and a l-inch (free) drop from any probable direction.

Table XV. Random Vibration Requirements for VSCS

| Frequency, Hz | Level |
|---|---|
| 20-1000 | 0.02 G2/Hz |
| 1000-2000 | -6 dB/octave |
| Overall | 5.5 Grms |

Figure 3-1 RESERVED

Figure 3-1 RESERVED

phase, four wire.

b. Frequency: 60 Hz +/-2.0%.

The power function within the VSCS shall meet the load balance specified in 3.3.2.3.1 of FAA-G-2100. The power source is a critical resource, and the VSCS design must be such as to minimize energy consumption; the VSCS design shall limit power consumption of the console position equipment to 510 Watts per console. The power function with in the VSCS shall meet the power factor specified in 3.3.2.3.2 of FAA-G-2100. The power function within the VSCS console equipment shall independently meet the power factor specified in 3.3.2.3.2 of FAA-G-2100.

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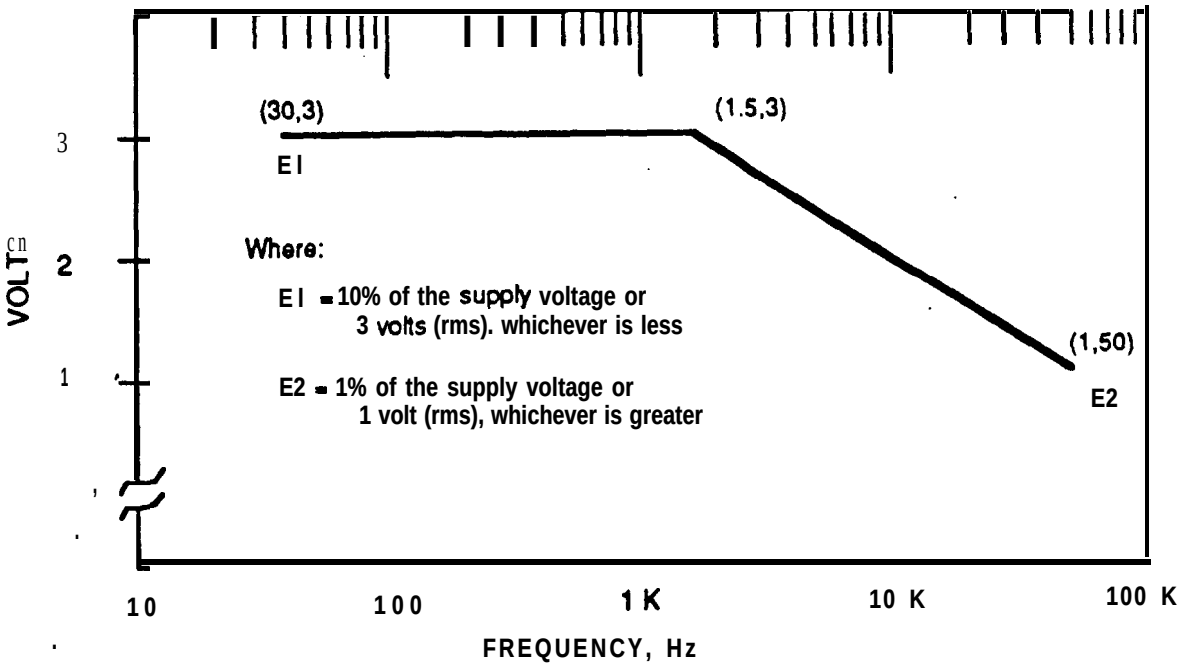


Figure 3-4: Limit for CS01

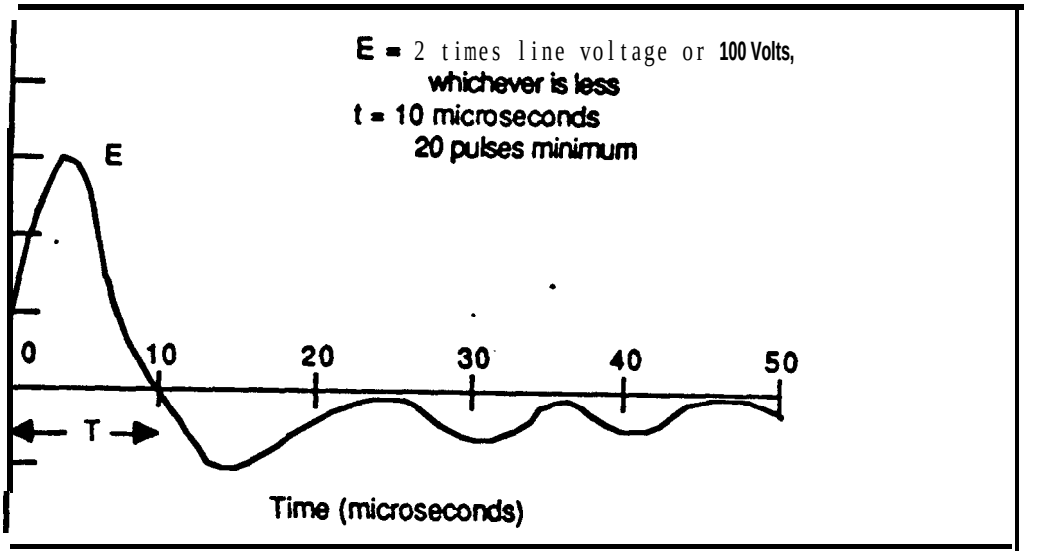


Figure 3-5: Limit for CS06

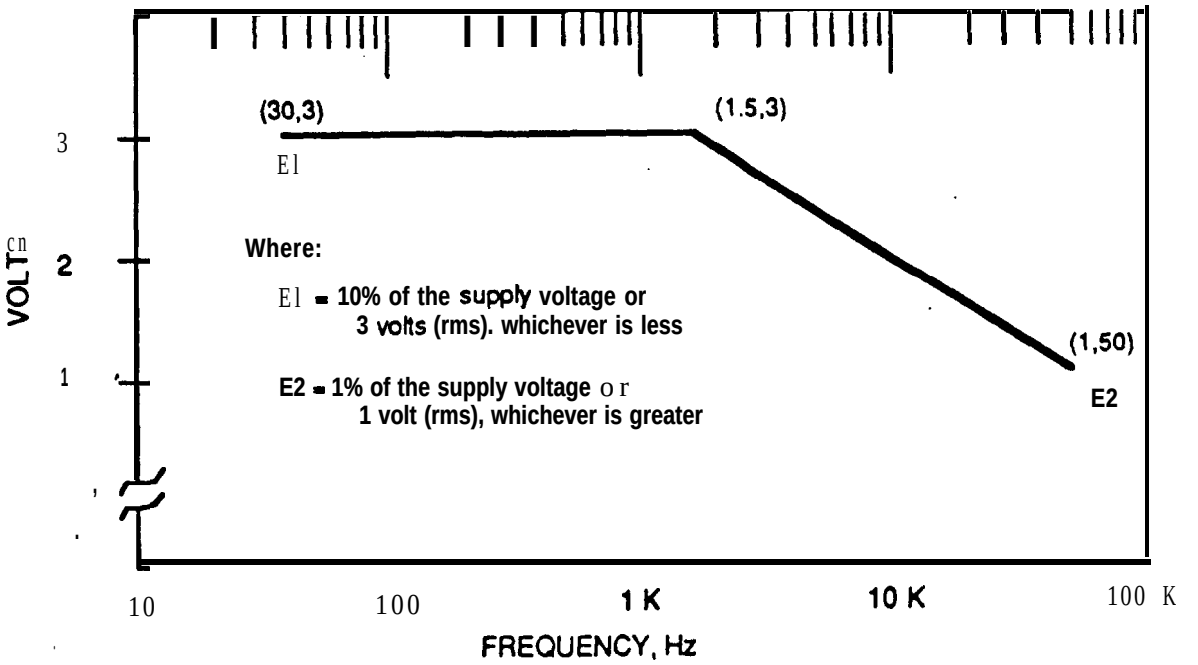


Figure 3-4: Limit for CS01

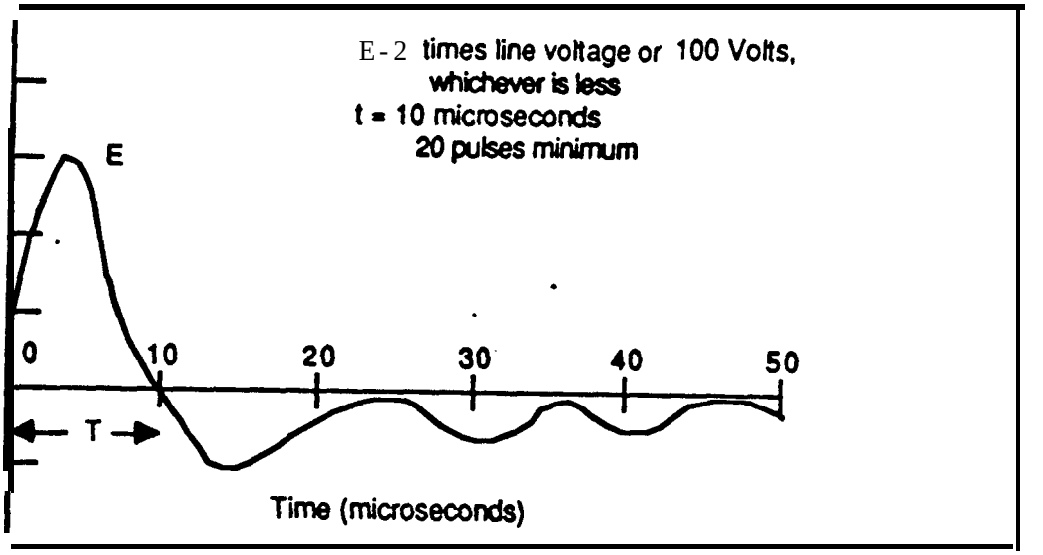


Figure 3-5: Limit for CS06

3.9.7.1 VSCS Site Power - The VSCS shall be capable of operating from unconditioned commercial ac line power as defined in FAA-G-2100.

3.9.7.2 VSCS Power Failure - The design of the VSCS shall be such that full operational functionality shall be maintained by all VSCS subsystems in the event of failure of any one of the AC power buses.

3.9.8 Power Distribution

The ac power shall be distributed to the VSCS in a dual critical ac busing arrangement. The power supplied will be uninterruptible, 120-Vac, single-phase, or 208-Vac, three-phase and will be regulated by the VSCS internal power supplies. The busing arrangement shall provide dual AC/DC power distribution to all VSCS equipment. The power shall be routed through two independent power paths physically separated to approach the equipment from opposite directions, such that a failure or obstruction of one AC/DC power bus will not disrupt AC/DC power on the other bus. Power distribution design and implementation shall be in accordance with National Electrical Code, NFPA-70, and FAA-C-1217.

3.9.9 Electrical Service Conditions, Transient State

The VSCS shall conform to FAA-STD-020, pertaining to Transient Protection Requirements. No false operational or output signals shall be generated by transients within the defined limits or by inrush currents caused by the VSCS.

3.9.10 Startup Surges

The peak inrush current during startup shall not exceed five times the normal peak operating current. The duration of the inrush operating current shall not exceed 50 milliseconds. The duration is defined as the time from input power application to the time at which the power returns to its steady state.

3.9.11 Power Supplies

Each power supply shall have front panel test points for measuring voltage outputs. Each power supply shall have a front-panel ac circuit breaker that can also be used as an ON-OFF switch during maintenance activities. The VCE ON-OFF switch should be located out of the controller's normal range of motion to prevent accidental activation. Each power supply shall contain electronic circuitry to prevent damage caused by external short circuits. The power supply shall recover immediately upon the removal of external short circuits. The electronic short circuit protection circuit shall allow removal or addition of electronic modules of capacitive loads to be switched ON without causing any circuit protection devices to operate or induce any other side effects. Each power supply shall include circuitry to activate a remote alarm at the maintenance position. Power supplies shall allow power-on installation or removal of VSCS plug-in assemblies without degradation to the VSCS or any VSCS assembly.

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common carrier facilities, this ground shall be connected to their grounding system.

3.9.15 Position Equipment Divided Power Connections

Power connection to VSCS display panels and console equipment shall be wired from two opposing directions from outside the console. Power distribution within the room shall be physically separated to approach the equipment from opposite sides and shall originate from separate dual source ac power system branch circuits (see 3.9.11).

3.9.16 AC Line Receptacle and Power Cord

All receptacle and power cords shall be in accordance with 3.3.2.1.4 of FAA-G-2100.

# 3.10 SOFTWARE

## 3.10.1 Software Categories

The VSCS software architecture allocates VSCS functions in three major categories: (a) system software, (b) applications software, and (c) support software. System functions shall include capabilities that apply across the VSCS; capabilities that are common to many or all of the functions; and capabilities that provide for the development, generation, utilization, and maintenance of various computer programs. All stored programs executed by a processor or controller, regardless of implementation technique, shall be considered as software.

### 3.10.1.1 System Software

**3.10.1.1.1** Operating System - The operating system and associated software shall provide the following capabilities.

**3.10.1.1.1.1** Real-time Executive - The operating system shall provide a mechanism to schedule and cancel tasks, provide data transfer mechanisms between tasks, and process external and time-based interrupts.

3.10.1.1.1.2 File Management Facility - The system shall provide mechanisms for locating files and for accessing, locking, and updating file information at the record level. The file management facility is required in such functions as traffic data reduction, described in 3.5.

**3.10.1.1.1.3** Command File Procedures - The system shall provide a mechanism for executing files containing procedural sequences of operating system commands and utilities.

3.10.1.1.2 Utilities - The system shall provide utility libraries and modules that include the following items.

**3.10.1.1.2.1** Data Management Libraries - Data management libraries shall include modules to sort databases on multiple keys, retrieve data from files based on multiple keys, cross reference data in two files based on a single key.

**3.10.1.1.2.2** Mathematical Libraries - Mathematical libraries shall include procedures to perform standard mathematical tasks that are required by VSCS functions, such as RTQC, statistical data analysis.

**3.10.1.1.2.3** Menu Generation Capabilities - The system shall provide mechanisms for constructing menu definitions and for interfacing these definitions with a high-level programming language.

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duplicate storage of data and programs,

c. The software design shall provide logical and physical data independence. Changes made to the logical structure of the data shall not impact the application programs. Changes made to the physical structure of the data shall not impact the logical structure of the data or the application programs. The VSCS shall permit changes to both the form of storage and to the position of data in the storage medium without impact to the application programs or the logical structure of the data,

d. The software design shall- ensure that the system is initialized to a correct, well defined state upon recovery from a fault and that all processing interrupted by a fault is properly continued after recovery,

e. The software design shall incorporate the commercially available operating system(s) that is applicable to the processing elements and consistent with the selected design and architecture for immediate installation, together with commercially available compiler, loader, librarian, and other debug and utility tools.

**3.10.2.1.1** Unit Attributes - The software design shall be functionally and operationally modular to:

a. Facilitate system expansion, modification, and configuration control,

b. Enhance system reliability by facilitating fault detection, diagnosis, containment, recovery, and fault-tolerant behavior,

c. Facilitate database changes to the lowest practical level without large program reassemblies.

**3.10.2.1.2** Design Representation - The design shall be represented in a manner that facilitates traceability to the specification, ease of understanding, and ease of design implementation. The representation shall be maintained as part of the design database. The design representation for the VSCS can be any available Program Design Language (PDL) that satisfies the following requirements:

a. Provide a natural expression of the control constructs specified for code development,

b. Be compatible with the properties and facilities of the target language candidates and their automated tool implementations,

c. Facilitate a precise specification of the design and impose a rigorous structure on the design,

d. Be directly processable by the tools specified herein to facilitate the analysis provisions noted and to enable automated standards enforcement to be accomplished,

e. Be comprised of successive, independent levels of abstraction with an independent set of objects and the operations on these objects defined at each level,

f. Explicitly document des'ign decisions with high-order decisions not affected by low-level implementation,

g Be expressed in such a way that programmers receive only that information needed to complete a unit and users receive only that information needed to use a unit,

h Provide formal, testable unit specifications with design decisions decoupled and encapsulated, interfaces explicitly defined, and complete documentation of dependencies,

i Permit only procedures within a unit to access the data of that unit, while restricting other units to access that data only through the interface provided by those procedures,

j Allow only functional interfaces to be shared by users and providers, with users seeing only abstract properties.

3.10.2.1.3 Special Tools and Techniques - Automated design support tools shall be used to record, analyze, and maintain the VSCS software design. These tools shall provide:

a. Traceability of software system components to software requirements,

b. Completeness and consistency testing of all software units,

c. The means to verify adherence of the design to software design standards,

d. The means to indicate in the design representation that a design feature is incomplete and to later identify and track all such incomplete design features,

e. Various printed outputs such as source listings, error lists, cross-reference lists, flow charts, hierarchy charts, design changes, history logs, etc.

The tools shall be applicable throughout the software development and maintenance life cycle. They shall address all aspects of operational software design including algorithms, data structures and files, and interfaces. The tools shall encourage and facilitate design of software in accordance with FAA-approved design techniques and standards.

All tools used during software design, and needed for software maintenance, shall be delivered to the FAA.

**3.10.2.2** Software Implementation - All VSCS software shall be developed in accordance with programming standards approved by the FAA. These standards shall include the use of modern structured programming techniques,

e. Be comprised of successive, independent levels of abstraction with an independent set of objects and the operations on these objects defined at each level,

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anomalies,

g. Unit testing and debugging facilities, including data recording and reduction,

h. Compilation, linking, and loading,

i. Data management,

j. Verification of adherence to software programming standards.

All tools used during software implementation shall be delivered to the FAA for software maintenance.

3.10.2.3 Design Language, Tools, Development Aids and Higher Order Language - All software detailed designs and codes shall be expressed in VSCS standard language. The standard for detailed design shall be a text-processor PDL, which incorporates selected design features, such as modularity, packaging, information hiding, and data abstraction. The PDL shall be used to promote transportability. Other software development tools, including those for configuration management, data management, and real-time applications shall be evaluated and selected, and described in the related documents.

3.10.3 Software Reliability - VSCS software shall have the following reliability characteristics:

a. Fault avoidance. The software shall be specified, desianed. and implemented to achieve high reliability in accordance with the detailed software design and construction requirements presented in 3.10.2.

b Fault detection. The VSCS shall have the capability to detect its own software-induced failures. Software fault detection techniques used in the VSCS shall provide for detecting software failures in sufficient time to permit recovery of all functions that the software supports within the response-time thresholds specified for the functions.

c Fault tolerance - The software shall provide fault-tolerant mechanisms that ensure continuing required functions without causing an interruption in service. These techniques may include, but are not limited to: (a) recovery block schemes (which cause switching to a spare block of code), and (b) protective redundancy (which includes multiple storage of critical variables and data,' diagnostic program, and'automatic program reloads).

d Fault containment. The following fault containment considerations shall be incorporated into the VSCS software design:

1. The software design shall prevent the propagation of software errors. No information shall be passed unless error boundary conditions are satisfied.

2. The system shall be designed to protect itself against errors in operation or data that may be introduced as the result of incorrect synchronization of software. For example, the VSCS should have a protection or fault data logger on in case of running out of "tape", or no communication line available.

3. Only explicitly specified sharing and exchange of information among software units (modules) shall be permitted.

## I 3.11 SECURITY AND SAFETY

### 3.11.1. Security

The security requirement on the VSCS shall be in accordance with FAA Order 1600.54, Security of FAA Automatic Data Processing Systems and Facilities.

The VSCS shall protect all information within the system. It shall protect as a minimum, data, data stores, and hardware components from unauthorized manipulation and shall provide user access verification.- The VSCS shall ascertain user authorization for system entry and ensure that unauthorized users are precluded. All system entries and attempted entries shall be reported to the MPS and a designated supervisory position.

**3.11.1.1 Remote Terminal Access Control** - Access to the VSCS through a remote terminal shall be protected and strictly limited to authorized personnel. At a minimum, access shall require entry of employee identification and security authorization. User authorization shall be flexible and restricted to permit predefined privileges only. All remote terminal access attempts and commands shall be included in the maintenance fault-reporting log.

### I 3.11.2 Safety

I The VSCS system shall be compliant in all aspects with OSHA Safety and Health Standards (29 CFR 1910). System safety engineering principles shall I be applied throughout the design, development, manufacture, test, checkout, operation, and maintenance of the VSCS, in accordance with the following I requirements of MIL-STD-454:

a. Requirement 1: Safety (Personnel Hazard),
b. Requirement 2: Flammable Materials,
c. Requirement 8: Electrical Overload Protection, Class 1 Equipment,
d. Requirement 45: Corona and Electrical Breakdown Prevention.

## 3.12 TRANSITION REQUIREMENTS

### 3.12.1 Operational Redundancy

The VSCS shall be designed, installed, integrated, and tested in such a way that it is operationally redundant with the existing FAA systems that it will replace.

### 3.12.2 Transition Equipment

A transition switch shall provide switchover between the VSCS and the existing communications equipment to access the G/G IP/PABX trunks, the A/G radio audio and control (RCE, BUEC, and existing radio interfaces) and the Legal Recorders. The switchover shall be on a line-by-line basis for testing and as a whole for transferring ATC communications operations. Special interface equipment shall be provided as necessary to ensure continuing operation of the existing communications equipment as interim provisional backup for VSCS operations. The transition switch shall provide for complete access to the existing communications equipment or the VSCS and its interfacing equipment(s), as selected by ATC operations personnel.

Transition Switching of all paths of either the VSCS or existing communication system shall be manually initiated from a single remote control point which shall be capable of being located up to 1000 feet from the transition switch equipment. The transition switch shall also have a local point of control at the switch. The designation of the point of control (local or remote) shall be under key security.

Switchover between the VSCS and existing communication system shall be completed within 1 second. Visual indication of whether the switchover was successful or unsuccessful shall be provided at the local and remote control point.

### 3.12.3 Communication System Availability

The total communications capability of the existing switching system and the FAA radio control system shall be available for ATC operations at all times during the installation, integration, acceptance testing, cutover, and during operation of the VSCS, as provided by the transition equipment specified herein, except for the time that individual positions are released for installation of VSCS equipment(s). The transition switch equipment shall be capable of installation and removal without degrading the performance of the VSCS or existing communciations system.

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The hardware quality control system shall be in accordance with FAA-STD-016, Quality Control System Requirements. The hardware quality control system shall provide for inspection and testing according to written standards of quality that specify definitive, measurable criteria to enable such inspections and tests to confirm compliance with these standards and assure that all delivered materials and equipment meet contract requirements. Included are control of purchased material procedures to ensure the acceptable quality of subcontractors' and other suppliers' equipment, and test control procedures for each configuration item to ensure the validity of all tests and results.

The hardware Quality Control plan shall include quality assurance activities related to the review and audit requirements of MIL-STD-1521 and the contract. The plan shall also address hardware documentation quality control in accordance with Section 1.4 of FAA-D-2494/b. Hardware configuration management shall be in accordance with FAA-STD-021.

4.2.2 Software Quality Control

The software quality assurance program shall be established and maintained in accordance with FAA-STD-018. The software quality assurance program shall provide for reviews and audits, and testing of all software throughout the contract period to ensure that all software and documentation meet contract requirements. Software configuration management shall be in accordance with FAA-STD-021.

Written standards of quality shall be established that specify definitive, measurable criteria to enable inspections and test to confirm compliance with these standards and assure that software meets contract requirements. Included are controls to be applied to software documentation, to test documentation, and to other documentation.

4.2.2.1 Software Stability Tests - The operational software shall be tested in as realistic an environment as is possible in the factory. During the functional testing of the operational system, software stability shall be ensured over a 7-day period of continuous 24-hour/day operation. These measurements shall determine that system halts or instabilities that may indicate marginal operation (e.g., approaching saturation limits of input/output (I/O) buffers) do not occur at a frequency that will preclude operational use of the system. The following requirements shall be followed for the stability tests:

a. Hardware faults shall be corrected and -retested. A test fault shall be determined to be software if it can not be demonstrated to be a hardware fault or due to an out-of-tolerance power condition.

b. Intermittent hardware faults must be demonstrated to be hardware and corrected or they will be logged as software faults. Software faults shall include anomalies in test results from test procedures. and all console software error messages that occur

during testing. Console error messages that indicate marginal system operation such as I/O buffer shortage, operating system time outs, or others shall be logged as software faults.

c. Software faults shall be categorized as system or simple, and repeatable or nonrepeatable. A system fault is one that causes the system to be unavailable to any one position or to the VSCS external interface for more than 10 seconds. Unavailable means that the system does not respond to attempted inputs from that interface. Simple faults are all software faults that are not system faults.

d. Repeatable system faults shall be corrected and retested. Repeatable simple faults shall be logged and isolated to the appropriate software unit/module. Repeatable simple faults shall be corrected and retested. The FAA shall have the option of continuing testing or requiring correction before resuming testing.

e. The stability of the operational software shall be measured. The measure of stability shall be the number of system faults and the number of nonrepeatable simple faults that occur over a 7-day period of continuous running of the operational system. If any system faults or ten nonrepeatable simple faults occur during this time, the test results shall be considered unacceptable. The software problems shall be isolated and corrected and the stability test rerun.

f. Stability tests shall be conducted with at least 100% of the traffic load provided by the CTSU to the entire system. Any deterioration of audio quality caused by the stability tests shall be investigated, corrected, and retested.

4.2.2.2 Software Stress Tests - Software stress tests shall include unexpected or extreme conditions as follows:

(a) Erroneous inputs.

(b) Maximum or overload processing demands.

(c) Simulated failure of software and induced failure of hardware components.

(d) Unexpected conditions that may occur in the operational environment.

4.2.2.3 Test Results - The software test results shall identify the following:

a. Nominal behavior of the software,

b. Range of functions that can be accomplished successfully by the software,

c. Errors in the software,

d. Special cases requiring additional testing,

e. Ability to survive erroneous inputs,

f. Ability to meet voice intelligibility (3.4.2.3.8.4) and voice delay (3.2.2.2.28) requirements.

**4.2.3** Design Reviews and Configuration Audits

The VSCS design shall be reviewed and audited at key points during the contract, following MIL-STD-1521 to assess the progress of the development process and the quality of the evolving system.

4.3 RESERVED

4.4 RESERVED

## 4.5 DEVELOPMENTAL TESTING AND EVALUATION (DT&E)

The VSCS hardware and software shall be developmentally tested and evaluated to assist the engineering design and development process and to verify attainment of technical performance specifications and objectives. The VSCS DT&E shall be based on a bottom-up building-block approach that takes a well defined subset of VSCS requirements and validates compliance of that building block with its requirements before proceeding to the next higher level of integration. Major test series shall progress from the unit level, to the subsystem level, combined subsystem and, finally, up to the system test level. Functional capabilities of each successive building block shall increase until the final building block implements all VSCS requirements. In the event of test failure, repeat testing shall be conducted. Regression tests shall be introduced after software or hardware changes have been implemented.

### 4.5.1 Test Classification and Levels

The tests to be conducted during the DT&E shall be classified as hardware tests, software test, and integration tests. The hardware test shall be conducted at the unit, subsystem, and system levels and the software tests at different CSC and CSCI levels. The integration tests shall be conducted at the unit, subsystem, combined subsystem, and at the system level as specified below.

### 4.5.2 Hardware DT&E

4.5.2.1 Unit Tests - Functional units of the.hardware shall be inspected and tested for conformity with the physical characteristics of design and construction as specified in 3.9. Also, the tests shall verify the functionality and performance requirements allocated to the unit in accordance with this specification.

4.5.2.2 Subsystem Tests - Hardware subsystem level tests shall verify input output (I/O); communications between functional units; timing and synchronization, and the physical, environmental, and EMC characteristics of 3.9.

4.5.2.3 System Tests - Total hardware system level tests shall verify that:

(a) All functional units perform in accordance with applicable hardware requirements when integrated and interconnected, and

(b) Interfaces between functional units of the VSCS operate according to hardware interface requirements prior to integrating hardware with software.

### 4.5.3 Software DT&E

The software unit (CSC) and subsystem (CSCI) shall be tested to verify as a minimum, unit processing and timing, and CSCI functional assembly, software timing, inter-CSCI communication, and stress testing.

4.5.4 Integration DT&E

4.5.4.1 Unit Functional Demonstration - Hardware and relevant software shall be integrated to demonstrate allocated functionality, performance, throughput timing and the outputs, products, and reports generated at the functional unit level.

4.5.4.2 Subsystem Integration Testing - Hardware subsystem shall be integrated with CSCI and tested at various loads up to the maximum loading conditions to determine functionality and performance characteristics. The test shall also verify error recovery and the output products and reports at the subsystem level.

4.5.4.3 Combined Subsystem Testing - Integrated subsystems shall be tested in combinations to verify I/O, intersubsystem communications, and synchronization. Human factors testing shall be conducted at this level as appropriate. The retesting of individual subsystems is required when the combined subsystems do not work together.

4.5.4.4 System Level Testing - After the successful conclusion of combined subsystem testing, the system shall be integrated and tested to verify that it meets the requirements for all functions, human factors, performance, RMA, environmental, EMC, error recovery, reports, and products at various load levels up to the maximum load.

4.5.4.5 Simulation Equipment - The contractor shall use the voice traffic and interface simulation equipment (TSU) developed during the VSCS prototype development phase to simulate ATC traffic loads during testing. The TSU shall provide loads up to 200% larger than those specified in Tables I and II.

4.5.4 Integration DT&E

4.5.4.1 Unit Functional Demonstration - Hardware and relevant software shall be integrated to demonstrate allocated functionality, performance, throughput timing and the outputs, products, and reports generated at the functional unit level.

4.5.4.2 Subsystem Integration Testing - Hardware subsystem shall be integrated with CSCI and tested at various loads up to the maximum loading conditions to determine functionality and performance characteristics. The test shall also verify error recovery and the output products and reports at the subsystem level.

4.5.4.3 Combined Subsystem Testing - Integrated subsystems shall be tested in combinations to verify I/O, intersubsystem communications, and synchronization. Human factors testing shall be conducted at this level as appropriate. The retesting of individual subsystems is required when the combined subsystems do not work together.

4.5.4.4 System Level Testing - After the successful conclusion of combined subsystem testing, the system shall be integrated and tested to verify that it meets the requirements for all functions, human factors, performance, RMA, environmental, EMC, error recovery, reports, and products at various load levels up to the maximum load.

4.5.4.5 Simulation Equipment - The contractor shall use the voice traffic and interface simulation equipment (TSU) developed during the VSCS prototype development phase to simulate ATC traffic loads during testing. The TSU shall provide loads up to 200% larger than those specified in Tables I and II.

Corrective Maintenance and Preventive Maintenance (PM) demonstration tests on VSCS equipment shall be on the first production system.

4.6.2.1 Corrective Maintenance Test - The corrective maintenance demonstration shall be in accordance with MIL-STD-471, except as modified in this paragraph. The task selections shall be as stated in Appendix A of MIL-STD-471. The statistical corrective maintenance tasks shall have failure modes statistically chosen. Test Method 8, Plan Al plus Plan B1 of MIL-STD-471, shall be used for all corrective maintenance tasks. These tests shall be tailored to include the more stringent test level imposed by the availability requiremnt of .9999999.

4.6.2.2 PM Test - The PM demonstration on the VSCS shall be in accordance with FAA-approved maintenance. The FAA will select PM tasks contained in the approved procedures to be performed during the PM demonstration test. The total number of tasks shall be-the same as those contained in the instruction manuals. The procedures shall also list the recommended frequency at which the tasks are to be performed and the time required to perform these tasks. Equipment required for operational (on-line) use shall not be preempted for PM. The ability to perform PM without degrading system performance shall be demonstrated.

4.6.2.3 Maintainability Demonstration Test Log - A chronological test log shall provide the dates and times of all significant events. The following is a list of events that must be recorded:

a. Power on and off times of each equipment or equipment group,

b. Start and stop times of demonstration testing,

c. Functions, modes, and phases of tests, including random tests,

d. All interruptions of tests, including all failure details,

e. Any unusual operating conditions.

4.6.2.4 Maintainability Demonstration Test Report - A maintainability demonstration test report shall be in accordance with the schedule. This report shall document the results of the test. It shall provide the detailed calculations of the demonstration maintainability of each subsystem. The report shall also include a copy of the maintainability demonstration test log.

## 4.7 TEST EQUIPMENT

For tests conducted on site, all necessary test equipment shall be delivered to the FAA on time, calibrated, and fully operational to support all tests. Use of FAA test equipment may be possible where this test equipment is on site and is available and meets all specified test equipment requirements. All test equipment used during the factory or site tests shall be standard commercial equipment and shall not be modified. The test equipment shall operate in the manner specified by the test equipment manufacturer. Use of custom test equipment or modified commercial test equipment requires approval in writing by FAA. Recalibration of test equipment used in the test program may be required due to the following:

a. The test equipment is removed from the test setup for unrelated purposes,

b. The test equipment fails or is damaged, or seems to be operating in a faulty manner based on FAA evaluation of test results.

## 4.8 RETEST

The reasons for all failures and noncompliances shall be determined. All corrective action necessary shall be taken to ensure full specification compliance. All repair or rework shall be completed prior to submission for retest. The FAA will determine the extent of retest required. No retest shall be started until all documentation has been submitted concerning the noncompliance and the corrective action taken, and the FAA agrees to start the retest. If a review of the reasons for failure to comply with specification requirements indicates that the cause may exist as latent defects in items previously accepted, the defects in all units shall be corrected in a timely manner, even those previously accepted by FAA.

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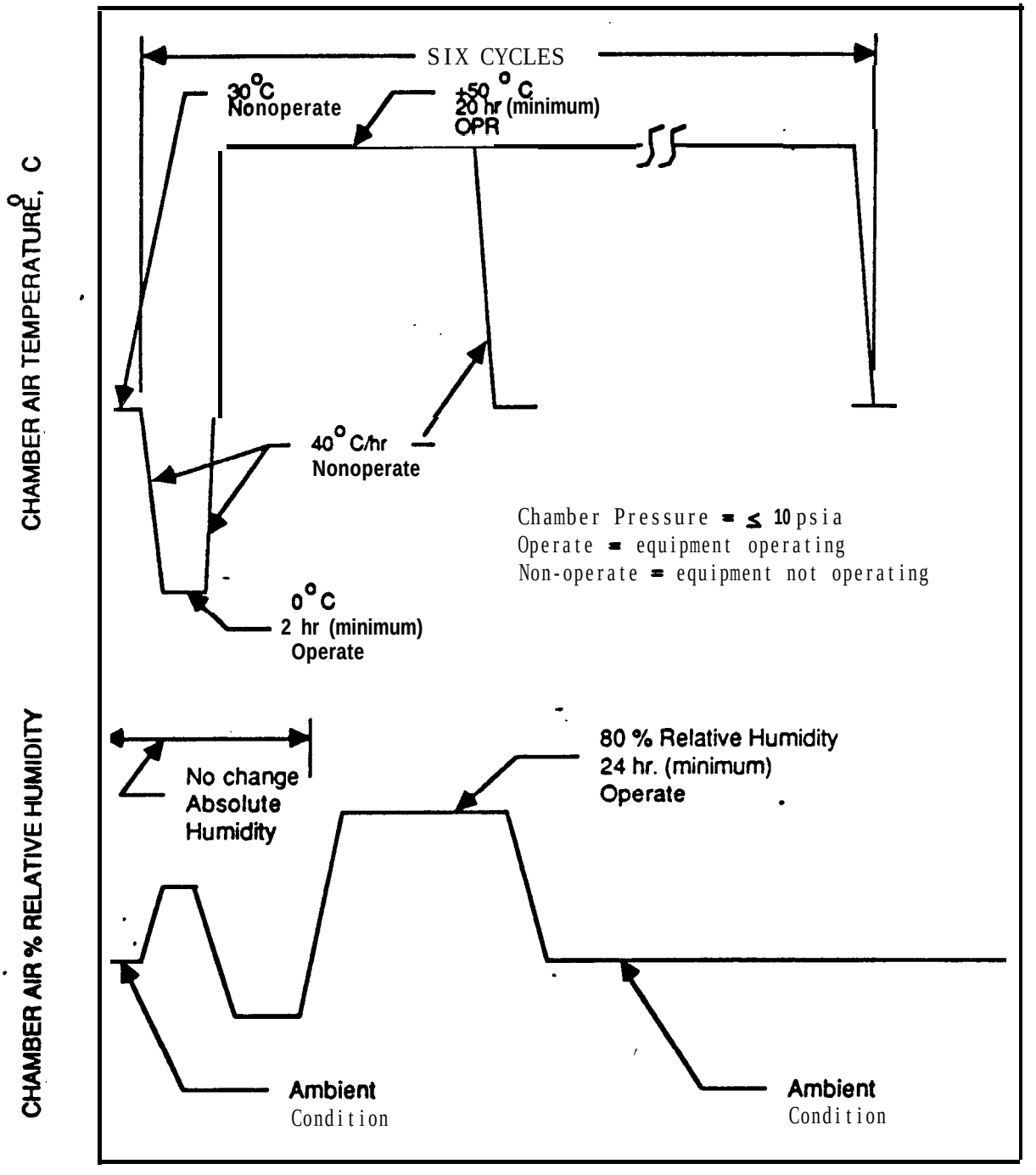


Figure 4-1. VSCS Design-Qualification Thermal Vacuum Test Conditions

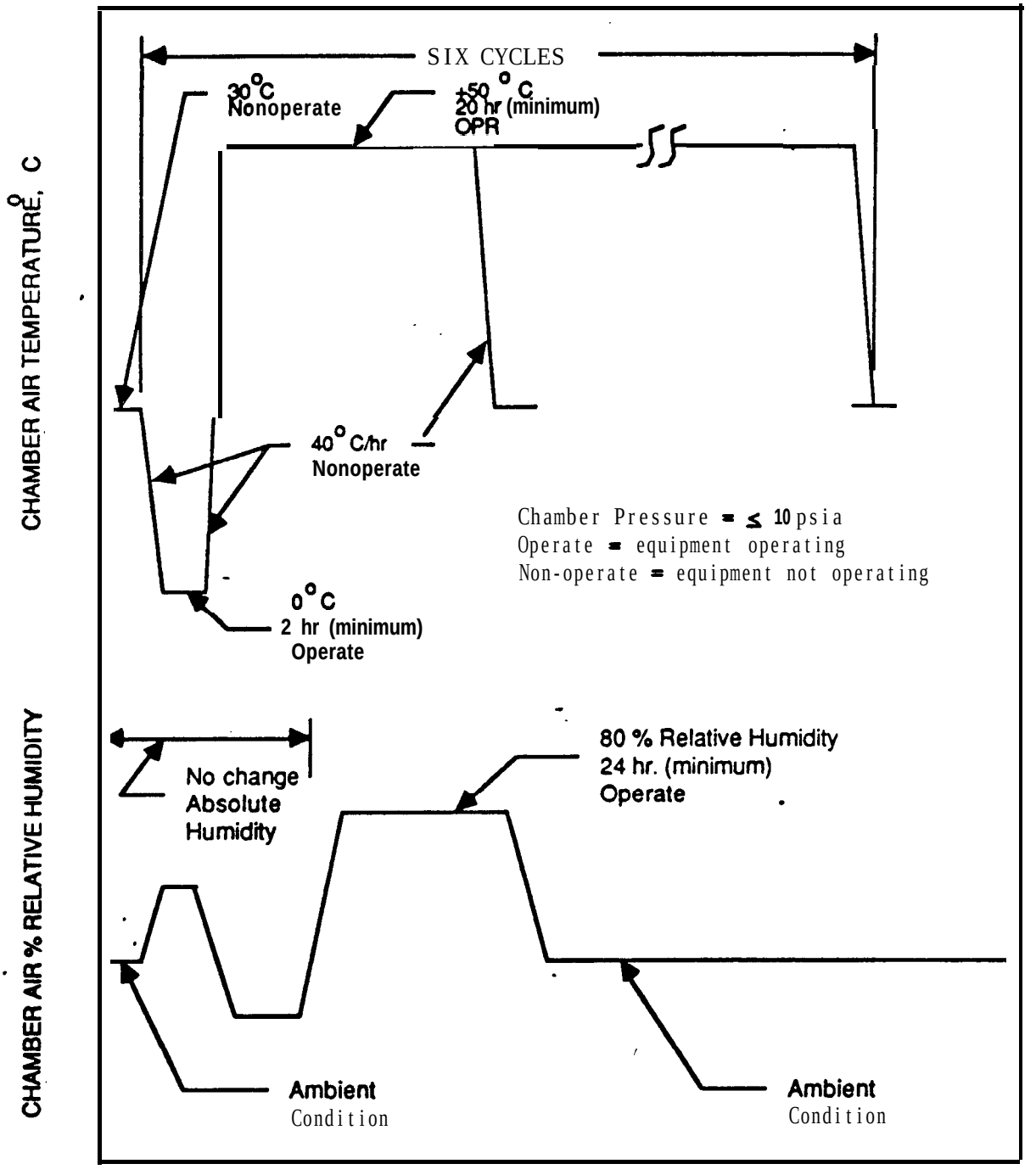


Figure 4-1. VSCS Design-Qualification Thermal Vacuum Test Conditions

Figure 4-2. RESERVED

Figure 4-2. RESERVED

## 4.11 QUALITY CONFORMANCE REQUIREMENTS

Each formal test plan shall delineate each specific VSCS requirement to be demonstrated during the test. Included with each requirement will be an indication of the method to be used to demonstrate the requirement, the expected output or results, and how the results will be analyzed to determine success or failure. In each formal test procedure, the requirement identification will be noted at the beginning of the procedure steps which test the requirement. Requirement identification will consist of the number used in this specification.

The requirement identifications called out in the test plan will be noted one or more times within the associated procedure. Each test report will contain a section that delineates all requirements demonstrated during the test followed by an indication of the actual output or results and a statement concerning the success or failure of the demonstration. The Requirements Verification Methods described in 4.12 shall be a living table included and maintained in formal test plans. The corresponding test report for each test plan will include Table XVI updated to reflect the relative completeness of requirement satisfaction and the deviations or liens necessary to proceed to the next level of test activities.

## 4.11 QUALITY CONFORMANCE REQUIREMENTS

Each formal test plan shall delineate each specific VSCS requirement to be demonstrated during the test. Included with each requirement will be an indication of the method to be used to demonstrate the requirement, the expected output or results, and how the results will be analyzed to determine success or failure. In each formal test procedure, the requirement identification will be noted at the beginning of the procedure steps which test the requirement. Requirement identification will consist of the number used in this specification.

The requirement identifications called out in the test plan will be noted one or more times within the associated procedure. Each test report will contain a section that delineates all requirements demonstrated during the test followed by an indication of the actual output or results and a statement concerning the success or failure of the demonstration. The Requirements Verification Methods described in 4.12 shall be a living table included and maintained in formal test plans. The corresponding test report for each test plan will include Table XVI updated to reflect the relative completeness of requirement satisfaction and the deviations or liens necessary to proceed to the next level of test activities.

Table XVI. Requirements Verification Methods

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.1.3 | System Design and Constructuion Features | I |
| 3.1.3.1 | A/G Backup switch | A |
| 3.1.3.2 | Architecture | ID |
| 3.1.3.2.1 | Voice and Data Resource Constraints | AT |
| 3.1.3.2.2 | Adaptability | D. |
| 3.1.3.2.3 | Failure impact limitation | AT |
| 3.1.3.3.1 | Two types of VSCS position equipment | I |
| 3.1.4.1 | Radio Communication and Control | D |
| 3.1.4.2 | BUEC | D |
| 3.1.4.3 | G/G Communication | D |
| 3.1.4.3.1 | IC | D |
| 3.1.4.3.2 | IP | D |
| 3.1.4.3.3 | PABX Interface Function | D |
| 3.1.4.4 | VSCS Switching Features | D |
| 3.1.5 | Reconfiguration Functions | D |
| 3.1.6.1 | Timing and Synchronization | I |
| 3.1.6.2 | Power Supply | I |
| 3.1.6.3 | Classmarks | AD |
| 3.1.6.4 | Numbering Plan | AD |
| 3.1.7 | Interface Design Features | AI |
| 3.1.8.1 | Backbone Microwave system | ID |
| 3.1.8.2 | Leased Transmission Service | ID |
| 3.1.8.3 | Telephone Networks | ID |
| 3.1.8.4 | Integrated Communications Switching System (ICSS) | ID |
| 3.1.8.5 | Tower Communications Switch (TCS) | ID |
| 3.1.8.6 | Traffic Management Voice Switch (TMVS) | ID |
| 3.1.8.7 | A/G Communications Network | ID |
| 3.1.9.1 | Maintenance Staffing Limit | A |
| 3.1.9.2 | Fault Detection and Isolation | AD |
| 3.1.9.3 | Testing | AD |
| 3.1.9.4 | Certification | AD |
| 3.1.10.1 | ATC Operational Training | D |
| 3.1.10.2 | Traffic Data Collection, Reduction, and Analysis | AD |
| 3.1.10.3 | Security | AD |
| 3.1.11 | Software Features | A |
| 3.1.11.1 | Operating Systems | AD |
| 3.1.12 | Alternate Standards | AI |
| 3.2.1 | Capacity, Modularity, and Growth | I |
| 3.2.1.1 | Capacity | AD |
| 3.2.1.2 | Modularity and Growth | DT |
| 3.2.2.1 | Grades of service and traffic loads: PBH and PBM | T |
| 3.2.2.2 | Throughput timing requirements | T |
| 3.2.2.2.1.1 | A/G PTT transmit response time | T |
| 3.2.2.2.1.2 | A/G PTT indicator response time | T |
| 3.2.2.2.1.3 | System-generated A/G PTT transmit response time | T |
| 3.2.2.2.1.4 | A/G PTT release transmit | T |
| 3.2.2.2.1.5 | A/G PTT release indicator | |
| 3.2.2.2.1.6 | Frequency Selection | T |
| 3.2.2.2.1.7 | Frequency Deselection | T |
| 3.2.2.2.1.8 | Cross Coupling Selection | T |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.2.2.2.1.9 | Cross Coupling Deselection | T |
| 3.2.2.2.1.10 | Frequency Preemption Activation | T |
| 3.2.2.2.1.11 | A/G Lockout Busy Tone | T |
| 3.2.2.2.2 | A/G Backup Switch Switchover Response Time | T |
| 3.2.2.2.3 | M/S TX/RX Transfer and Confirmation Response Time | T |
| 3.2.2.2.3.1 | M/S TX/RX Transfer Response Time | T |
| 3.2.2.2.3.2 | M/S TX/RX Transfer Confirmation Response Time | T |
| 3.2.2.2.4 | Receiver Muting Response Time | T |
| 3.2.2.2.4.1 | Remote Receiver Muting Response Time | T |
| 3.2.2.2.4.2 | Remote Receiver Muting Confirmation Response Time | T |
| 3.2.2.2.4.3 | Remote Receiver Mute Deselect | T |
| 3.2.2.2.4.4 | Remote Receiver Mute Deselect Indicator | T |
| 3.2.2.2.4.5 | Local Receive Muting Select | T |
| 3.2.2.2.4.6 | Local Receive Mute Select Indicator | T |
| 3.2.2.2.4.7 | Local Receive Muting Deselect | T |
| 3.2.2.2.4.8 | Local Receive Mute Deselect Indicator | T |
| 3.2.2.2.5 | Site Selection Response Time | T |
| 3.2.2.2.5.1 | Frequency Site Selection | T |
| 3.2.2.2.5.2 | Frequency Site Confirmation | T |
| 3.2.2.2.6 | G/G PTT Transmit and Indicator Response Time | T |
| 3.2.2.2.6.1 | G/G PTT transmit response time | T |
| 3.2.2.2.6.2 | G/G PTT release response time | T |
| 3.2.2.2.7 | IC Setup Response Time | T |
| 3.2.2.2.7.1 | IC call placement response time | T |
| 3.2.2.2.7.2 | IC call acceptance response time | T |
| 3.2.2.2.7.3 | IC OVR Call Placement/Acceptance Response Time | T |
| 3.2.2.2.8 | IC circuit release time delay | T |
| 3.2.2.2.8.1 | IA & IA Override Selection (IC) | T |
| 3.2.2.2.8.2 | IC Call Operation Indicator | T |
| 3.2.2.2.8.3 | IC Call Ringback Tone | T |
| 3.2.2.2.8.4 | IC Busy Tone | T |
| 3.2.2.2.9 | IP Call Setup Response Time | T |
| 3.2.2.2.9.1 | IP Call Placement Response Time | T |
| 3.2.2.2.9.1.1 | Position-to-trunk IP call placement response time | T |
| 3.2.2.2.9.1.2 | Trunk-to-position IP call placement response time | T |
| 3.2.2.2.9.1.3 | Position-to-trunk IP OVR Call Placement Response Time | T |
| 3.2.2.2.9.1.4 | Trunk-to-position IP OVR Call Acceptance Response Time | T |
| 3.2.2.2.9.2 | IP Call Acceptance Response Time | T |
| 3.2.2.2.9.2.1 | Position-to-trunk IP call acceptance response time | T |
| 3.2.2.2.9.2.2 | Trunk-to-position IP call acceptance response time | T |
| 3.2.2.2.10 | IP circuit release response time | T |
| 3.2.2.2.11 | Dial tone response time for indirect access | T |
| 3.2.2.2.12 | Display devices response time | T |
| 3.2.2.2.13 | TED detection response time | T |
| 3.2.2.2.14 | Radio Squelch Break Response Time | T |
| 3.2.2.2.15 | Radio Squelch Break Indication Response Time | T |
| 3.2.2.2.16 | Conference Call Operation/Conference Call Deselect | T |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.2.2.2.17 | Conference Call Indicator | T |
| 3.2.2.2.18 | Call Hold Operation -- Hold/Resume | T |
| 3.2.2.2.19 | Call Forward Operation/Call Forward Select | T |
| 3.2.2.2.20 | Call Forward Deselect | T |
| 3.2.2.2.21 | Call Forward Select Confirmation | T |
| 3.2.2.2.22 | Unacceptable Call Forward Alert | T |
| 3.2.2.2.23 | Call Transfer Operation/Call Transfer Selection | T |
| 3.2.2.2.24 | Unacceptable Call Transfer Alert | T |
| 3.2.2.2.25 | Common Answer Queue/Answer From Common Answer Queue | T |
| 3.2.2.2.26 | Confirm Calls in Common Answer Queue | T |
| 3.2.2.2.27.1 | Position Voice Monitor Selection | T |
| 3.2.2.2.27.2 | Voice Monitor Selection Confirmation | T |
| 3.2.2.2.28 | Voice Delay | T |
| 3.2.2.2.28.1 | Intafacility Voice Delay Measurement | T |
| 3.2.2.2.28.1.1 | Position to Position Voice Delay Measurement | T |
| 3.2.2.2.28.1.2 | Position to Trunk Voice Delay Measurement | T |
| 3.2.2.2.28.1.3 | Position to A/G Interface Voice Delay Measurement | T |
| 3.2.2.2.29 | PABX Beep Cycle | T |
| 3.2.2.3 | System errors | A |
| 3.2.2.3.1 | False service disconnects | DT |
| 3.2.2.3.2 | False request for service | DT |
| 3.2.2.3.3 | Incorrect dial code access | DT |
| 3.2.2.3.4 | PTT error rate | DT |
| 3.2.2.4 | Reconfiguration timing requirements | T |
| 3.2.2.5 | Degraded operation | AD |
| 3.2.2.6 | Voice Channel Performance Characteristics | T |
| 3.2.2.6.1 | Impedance | T |
| 3.2.2.6.2 | Background noise | T |
| 3.2.2.6.3 | Idle channel noise | T |
| 3.2.2.6.4 | Impulse noise | T |
| 3.2.2.6.5 | Crosstalk between channels | T |
| 3.2.2.6.6 | Frequency response | T |
| 3.2.2.6.7 | Intermodulation distortion | T |
| 3.2.2.6.8 | Harmonic distortion | T |
| 3.2.2.6.9 | Longitudinal balance | T |
| 3.2.2.6.10 | Gain tracking linearity | T |
| 3.2.2.6.11 | Talking State | T |
| 3.2.2.6.12 | VF Level Regulation | T |
| 3.2.2.6.12.1 | Transmit level regulation | T |
| 3.2.2.6.12.1.1 | 12-dB sudden increase | T |
| 3.2.2.6.12.1.2 | 12-dB sudden decrease | T |
| 3.2.2.6.12.2 | Receive level regulation | T |
| 3.2.2.6.12.3 | Multiple access level regulation | T |
| 3.2.2.7 | Sidetone | T |
| 3.2.2.8 | Long-term stability | AD |
| 3.2.3 | Reliability, Maintainability, Availability (RMA) | A |
| 3.2.3.1 | Position-level availability | A |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.2.2.2.17 | Conference Call Indicator | T |
| 3.2.2.2.18 | Call Hold Operation -- Hold/Resume | T |
| 3.2.2.2.19 | Call Forward Operation/Call Forward Select | T |
| 3.2.2.2.20 | Call Forward Deselect | T |
| 3.2.2.2.21 | Call Forward Select Confirmation | T |
| 3.2.2.2.22 | Unacceptable Call Forward Alert | T |
| 3.2.2.2.23 | Call Transfer Operation/Call Transfer Selection | T |
| 3.2.2.2.24 | Unacceptable Call Transfer Alert | T |
| 3.2.2.2.25 | Common Answer Queue/Answer From Common Answer Queue | T |
| 3.2.2.2.26 | Confirm Calls in Common Answer Queue | T |
| 3.2.2.2.27.1 | Position Voice Monitor Selection | T |
| 3.2.2.2.27.2 | Voice Monitor Selection Confirmation | T |
| 3.2.2.2.28 | Voice Delay | T |
| 3.2.2.2.28.1 | Intafacility Voice Delay Measurement | T |
| 3.2.2.2.28.1.1 | Position to Position Voice Delay Measurement | T |
| 3.2.2.2.28.1.2 | Position to Trunk Voice Delay Measurement | T |
| 3.2.2.2.28.1.3 | Position to A/G Interface Voice Delay Measurement | T |
| 3.2.2.2.29 | PABX Beep Cycle | T |
| 3.2.2.3 | System errors | A |
| 3.2.2.3.1 | False service disconnects | DT |
| 3.2.2.3.2 | False request for service | DT |
| 3.2.2.3.3 | Incorrect dial code access | DT |
| 3.2.2.3.4 | PTT error rate | DT |
| 3.2.2.4 | Reconfiguration timing requirements | T |
| 3.2.2.5 | Degraded operation | AD |
| 3.2.2.6 | Voice Channel Performance Characteristics | T |
| 3.2.2.6.1 | Impedance | T |
| 3.2.2.6.2 | Background noise | T |
| 3.2.2.6.3 | Idle channel noise | T |
| 3.2.2.6.4 | Impulse noise | T |
| 3.2.2.6.5 | Crosstalk between channels | T |
| 3.2.2.6.6 | Frequency response | T |
| 3.2.2.6.7 | Intermodulation distortion | T |
| 3.2.2.6.8 | Harmonic distortion | T |
| 3.2.2.6.9 | Longitudinal balance | T |
| 3.2.2.6.10 | Gain tracking linearity | T |
| 3.2.2.6.11 | Talking State | T |
| 3.2.2.6.12 | VF Level Regulation | T |
| 3.2.2.6.12.1 | Transmit level regulation | T |
| 3.2.2.6.12.1.1 | 12-dB sudden increase | T |
| 3.2.2.6.12.1.2 | 12-dB sudden decrease | T |
| 3.2.2.6.12.2 | Receive level regulation | T |
| 3.2.2.6.12.3 | Multiple access level regulation | T |
| 3.2.2.7 | Sidetone | T |
| 3.2.2.8 | Long-term stability | AD |
| 3.2.3 | Reliability, Maintainability, Availability (RMA) | A |
| 3.2.3.1 | Position-level availability | A |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.3.1.1.12.4 | Intra-RCE PTT lockout | DI |
| 3.3.2.1 | General requirements | DI |
| 3.3.2.1.1 | Intercom/interphone | DI |
| 3.3.2.1.2 | Routing of incoming G/G voice | D |
| 3.3.2.1.2.1 | Selection of G/G voice routing | D |
| 3.3.2.1.2.2 | Indication of voice routing | D |
| 3.3.2.1.2.3 | Incoming G/G call indication | D |
| 3.3.2.1.2.4 | Position relief briefing recording | D |
| 3.3.2.1.2.4.1 | Pos. relief brief. recording activation | D |
| 3.3.2.1.2.5 | Position voice monitoring | D |
| 3.3.2.1.2.5.1 | Position voice-monitoring restrictions | D |
| 3.3.2.1.2.5.2 | Position voice-monitoring access | D |
| 3.3.2.1.2.6 | PTT for G/G communications | D |
| 3.3.2.1.2.6.1 | PTT for G/G DA | D |
| 3.3.2.1.2.7 | ATIS monitoring | D |
| 3.3.2.2 | IC/IP | D |
| 3.3.2.2.1 | Active IC/IP calls | D |
| 3.3.2.2.2 | Call Disconnection | D |
| 3.3.2.2.2.1 | Call Release Designator | D |
| 3.3.2.2.2.2 | DA call designator release | D |
| 3.3.2.2.2.3 | Release by initiating a call | D |
| 3.3.2.2.2.4 | Release by answering a call | D |
| 3.3.2.2.2.5 | Release by resuming a call | D |
| 3.3.2.2.2.6 | Release indications | D |
| 3.3.2.2.2.7 | Last party release | D |
| 3.3.2.2.3 | DA | I |
| 3.3.2.2.3.1 | Number of DA selectors | I |
| 3.3.2.2.3.2 | Latching/nonlatching DA actions | D |
| 3.3.2.2.3.3 | DA OVR | D |
| 3.3.2.2.3.3.1 | DA OVR call initiation | DI |
| 3.3.2.2.3.3.2 | Nonlatching DA OVR call initiation | D |
| 3.3.2.2.3.4 | OVR call answering | I |
| 3.3.2.2.3.5 | OVR call indications | D |
| 3.3.2.2.4 | IA | I |
| 3.3.2.2.4.1 | IA call initiation | D |
| 3.3.2.2.4.1.1 | IA access keypad enable | D |
| 3.3.2.2.4.2 | IA call timeout | D |
| 3.3.2.2.4.3 | IA OVR calls | DI |
| 3.3.2.2.4.4 | CA queue | DI |
| 3.3.2.2.4.4.1 | Caller identification (ID) | DI |
| 3.3.2.2.4.4.2 | CA queue depth | DI |
| 3.3.2.2.4.4.3 | Call answer queue selection | DI |
| 3.3.2.2.5 | Call HOLD | DI |
| 3.3.2.2.5.1 | Resuming call on HOLD | DI |
| 3.3.2.2.6 | Call forwarding | DI |
| 3.3.2.2.6.1 | Enabling call forwarding | D |
| 3.3.2.2.6.2 | Disabling call forwarding | DI |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.3.1.1.12.4 | Intra-RCE PTT lockout | DI |
| 3.3.2.1 | General requirements | DI |
| 3.3.2.1.1 | Intercom/interphone | DI |
| 3.3.2.1.2 | Routing of incoming G/G voice | D |
| 3.3.2.1.2.1 | Selection of G/G voice routing | D |
| 3.3.2.1.2.2 | Indication of voice routing | D |
| 3.3.2.1.2.3 | Incoming G/G call indication | D |
| 3.3.2.1.2.4 | Position relief briefing recording | D |
| 3.3.2.1.2.4.1 | Pos. relief brief. recording activation | D |
| 3.3.2.1.2.5 | Position voice monitoring | D |
| 3.3.2.1.2.5.1 | Position voice-monitoring restrictions | D |
| 3.3.2.1.2.5.2 | Position voice-monitoring access | D |
| 3.3.2.1.2.6 | PTT for G/G communications | D |
| 3.3.2.1.2.6.1 | PTT for G/G DA | D |
| 3.3.2.1.2.7 | ATIS monitoring | D |
| 3.3.2.2 | IC/IP | D |
| 3.3.2.2.1 | Active IC/IP calls | D |
| 3.3.2.2.2 | Call Disconnection | D |
| 3.3.2.2.2.1 | Call Release Designator | D |
| 3.3.2.2.2.2 | DA call designator release | D |
| 3.3.2.2.2.3 | Release by initiating a call | D |
| 3.3.2.2.2.4 | Release by answering a call | D |
| 3.3.2.2.2.5 | Release by resuming a call | D |
| 3.3.2.2.2.6 | Release indications | D |
| 3.3.2.2.2.7 | Last party release | D |
| 3.3.2.2.3 | DA | I |
| 3.3.2.2.3.1 | Number of DA selectors | I |
| 3.3.2.2.3.2 | Latching/nonlatching DA actions | D |
| 3.3.2.2.3.3 | DA OVR | D |
| 3.3.2.2.3.3.1 | DA OVR call initiation | DI |
| 3.3.2.2.3.3.2 | Nonlatching DA OVR call initiation | D |
| 3.3.2.2.3.4 | OVR call answering | I |
| 3.3.2.2.3.5 | OVR call indications | D |
| 3.3.2.2.4 | IA | I |
| 3.3.2.2.4.1 | IA call initiation | D |
| 3.3.2.2.4.1.1 | IA access keypad enable | D |
| 3.3.2.2.4.2 | IA call timeout | D |
| 3.3.2.2.4.3 | IA OVR calls | DI |
| 3.3.2.2.4.4 | CA queue | DI |
| 3.3.2.2.4.4.1 | Caller identification (ID) | DI |
| 3.3.2.2.4.4.2 | CA queue depth | DI |
| 3.3.2.2.4.4.3 | Call answer queue selection | DI |
| 3.3.2.2.5 | Call HOLD | DI |
| 3.3.2.2.5.1 | Resuming call on HOLD | DI |
| 3.3.2.2.6 | Call forwarding | DI |
| 3.3.2.2.6.1 | Enabling call forwarding | D |
| 3.3.2.2.6.2 | Disabling call forwarding | DI |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.4.2.3.3.4' | IA Keypad Construction | ID |
| 3.4.2.3.4 | Data entry devices | ID |
| 3.4.2.3.4.1 | Operator review | ID |
| 3.4.2.3.4.2 | Keyboard configurations | ID |
| 3.4.2.3.5 | Display refresh | AID |
| 3.4.2.3.6 | Display brightness | ID |
| 3.4.2.3.7 | Feedback to operators | ID |
| 3.4.2.3.7.1 | Function timeouts | AD |
| 3.4.2.3.8.1 | Headsets/handsets and PTT switches | I |
| 3.4.2.3.8.2 | Loudspeakers | I |
| 3.4.2.3.8.2.1 | LS volume control | I |
| 3.4.2.3.8.3 | Foot Switch | I |
| 3.4.2.3.8.4 | Speech intelligibility | DT |
| 3.4.3 | Special Entry/display Controls | I |
| 3.4.3.1 | Reserved | |
| 3.4.3.2 | Display selection | ID |
| 3.4.4 | Ancillary positions | ID |
| 3.4.4.1 | Ancillary position requirements | I |
| 3.4.4.2 | Special classmark requirements | I |
| 3.4.4.3 | Reserved | |
| 3.4.5 | Supervisory positions | ID |
| 3.4.5.1 | Supervisory position equipment | I |
| 3.4.5.2 | Supervisory functions | ID |
| 3.4.5.2.1 | Supervisory monitoring of ATC positions | ID |
| 3.4.5.2.2 | Supervisory position voice recording and playback | I |
| 3.4.5.2.2.1 | Supervisory position voice recording and playback equipment | ID |
| 3.4.5.2.3 | Supervisory monitoring of operational position displays | ID |
| 3.4.5.2.4 | FTS monitoring of A/G | ID |
| 3.4.5.3 | Supervisory control of position reconfiguration | ID |
| 3.4.6 | VSCS local maintenance position | I |
| 3.4.6.1 | Local maintenance position equipment | ID |
| 3.4.6.1.1 | Local maintenance position features | ID |
| 3.4.6.1.2 | Test panel | ID |
| 3.4.6.2 | Local maintenance theory of operation | D |
| 3.4.7 | Data entry position | ID |
| 3.4.7.1 | Data entry position equipment | ID |
| 3.4.7.2 | Data entry position software | ID |
| 3.4.8 | Reconfiguration command entry and display | ID |
| 3.4.8.1 | Configuration map and access | ID |
| 3.4.8.1.1 | Hardcopy listings of configuration maps | ID |
| 3.4.8.1.2 | Reconfiguration status reporting | ID |
| 3.4.8.1.3 | Limitations of reconfiguration | ID |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.4.9.1 | Scope of display function hardware | I |
| 3.4.9.2 | VSCS Console Equipment | I |
| 3.4.9.2.1 | Position headset/handset/PTT jacks | ID |
| 3.4.9.2.2 | Reserved | |
| 3.4.9.3.1 | Communications control display devices | ID |
| 3.4.9.3.2 | Touch entry devices | ID |
| 3.4.9.3.3 | IA keypad entry and display devices | ID |
| 3.4.9.3.4 | Position loudspeaker(s) | ID |
| 3.4.9.3.4.1 | LS volume controls | ID |
| 3.4.9.3.4.2 | Provision for one LS | AI |
| 3.4.9.3.4.3 | LS performance | IT |
| 3.4.9.3.5 | Chimes | ID |
| 3.4.9.3.5.1 | Chime volume | ID |
| 3.4.10 | Location of console equipment | I |
| 3.4.11 | C/C equipment power | AT |
| 3.5 | Switching and control functions | ID |
| 3.5.1.1 | Modularity | ID |
| 3.5.1.2 | Program control | I |
| 3.5.1.3 | Technology utilization | IA |
| 3.5.1.4 | G/G Interface Compatability | I |
| 3.5.1.5 | A/G Interface Compatability | I |
| 3.5.2.1.1 | A/G Special Features | ID |
| 3.5.2.1.1.1 | Assigned frequencies | AD |
| 3.5.2.1.1.2 | Fan-in feature | ADT |
| 3.5.2.1.1.2.1 | Emergency frequency fan-in | AD |
| 3.5.2.1.1.3 | Fan-out feature | ADT |
| 3.5.2.1.1.3.1 | Emergency frequency fan-out | AD |
| 3.5.2.1.1.4 | Multiple locations of a frequency | D |
| 3.5.2.1.1.5 | Cross-coupling | D |
| 3.5.2.1.1.6 | Weather Recording Broadcast | D |
| 3.5.2.1.1.7 | PTT lockout | D |
| 3.5.2.1.1.7.1 | RCE trunk lockout signal | D |
| 3.5.2.1.1.7.2 | PTT lockout for multiple assignment of a frequency | D |
| 3.5.2.1.1.8.1 | Position jack preemption | D |
| 3.5.2.1.1.8.2 | PTT preemption | D |
| 3.5.2.i.1.8.3 | Weather Broadcast Preemption | D |
| 3.5.2.1.1.8.4 | Cross-coupling preemption | D |
| 3.5.2.1.2.1 | Configuration for A/G | DI |
| 3.5.2.1.2.1.1 | Configuration for RCE | DI |
| 3.5.2.1.2.2 | Frequency selection | DI |
| 3.5.2.1.2.2.1 | Frequency deselection | DI |
| 3.5.2.1.2.3 | PTT and voice transmission' | D |
| 3.5.2.1.2.3.1 | PTT for selective frequency operations | D |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.4.9.1 | Scope of display function hardware | I |
| 3.4.9.2 | VSCS Console Equipment | I |
| 3.4.9.2.1 | Position headset/handset/PTT jacks | ID |
| 3.4.9.2.2 | Reserved | |
| 3.4.9.3.1 | Communications control display devices | ID |
| 3.4.9.3.2 | Touch entry devices | ID |
| 3.4.9.3.3 | IA keypad entry and display devices | ID |
| 3.4.9.3.4 | Position loudspeaker(s) | ID |
| 3.4.9.3.4.1 | LS volume controls | ID |
| 3.4.9.3.4.2 | Provision for one LS | AI |
| 3.4.9.3.4.3 | LS performance | IT |
| 3.4.9.3.5 | Chimes | ID |
| 3.4.9.3.5.1 | Chime volume | ID |
| 3.4.10 | Location of console equipment | I |
| 3.4.11 | C/C equipment power | AT |
| 3.5 | Switching and control functions | ID |
| 3.5.1.1 | Modularity | ID |
| 3.5.1.2 | Program control | I |
| 3.5.1.3 | Technology utilization | IA |
| 3.5.1.4 | G/G Interface Compatability | I |
| 3.5.1.5 | A/G Interface Compatability | I |
| 3.5.2.1.1 | A/G Special Features | ID |
| 3.5.2.1.1.1 | Assigned frequencies | AD |
| 3.5.2.1.1.2 | Fan-in feature | ADT |
| 3.5.2.1.1.2.1 | Emergency frequency fan-in | AD |
| 3.5.2.1.1.3 | Fan-out feature | ADT |
| 3.5.2.1.1.3.1 | Emergency frequency fan-out | AD |
| 3.5.2.1.1.4 | Multiple locations of a frequency | D |
| 3.5.2.1.1.5 | Cross-coupling | D |
| 3.5.2.1.1.6 | Weather Recording Broadcast | D |
| 3.5.2.1.1.7 | PTT lockout | D |
| 3.5.2.1.1.7.1 | RCE trunk lockout signal | D |
| 3.5.2.1.1.7.2 | PTT lockout for multiple assignment of a frequency | D |
| 3.5.2.1.1.8.1 | Position jack preemption | D |
| 3.5.2.1.1.8.2 | PTT preemption | D |
| 3.5.2.i.1.8.3 | Weather Broadcast Preemption | D |
| 3.5.2.1.1.8.4 | Cross-coupling preemption | D |
| 3.5.2.1.2.1 | Configuration for A/G | DI |
| 3.5.2.1.2.1.1 | Configuration for RCE | DI |
| 3.5.2.1.2.2 | Frequency selection | DI |
| 3.5.2.1.2.2.1 | Frequency deselection | DI |
| 3.5.2.1.2.3 | PTT and voice transmission' | D |
| 3.5.2.1.2.3.1 | PTT for selective frequency operations | D |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.5.2.2.2.5 | Conferencing | AD |
| 3.5.2.2.2.5.1 | Meet-me conference | D |
| 3.5.2.2.2.5.2 | Progressive conference | D |
| 3.5.2.2.2.5.3 | Preset conference | D |
| 3.5.2.2.2.6 | Voice call | AD |
| 3.5.2.2.2.6.1 | Voice call, calling position | D |
| 3.5.2.2.2.6.2 | Voice call, called position | D |
| 3.5.2-Z-2.6.3 | Voice call, IA | D |
| 3.5.2.2.2.6.4 | Voice call release | D |
| 3.5.2.2.2.7 | Call forwarding | D |
| 3.5.2.2.2.8 | Call transfer | D |
| 3.5.2.2.2.9 | Call HOLD | D |
| 3.5.2.2.2.10 | Voice Routing | AD |
| 3.5.2.2.2.10.1 | Monitoring | D |
| 3.5.2.2.2.10.2 | Supervisory recording | D |
| 3.5.2.2.2.10.3 | Voice recording | D |
| 3.5.2.2.2.10.4 | HS/LS voice routing | D |
| 3.5.2.2.3.1 | Trunk signaling VSCS-VSCS | A |
| 3.5.2.2.3.2 | Trunk signaling interfaces with existing systems | A |
| 3.5.2.2.3.3 | Voice call signaling | AT |
| 3.5.2.2.3.4 | Selective signaling | D |
| 3.5.2.2.3.5 | Immediate dialing (type 7) | D |
| 3.5.2.2.3.6 | Trunk signaling, VSCS-PABX | D |
| 3.5.3.1.1 | Centralized operator communication | D |
| 3.5.3.1.1.1 | Supervisory positions | D |
| 3.5.3.1.1.2 | Maintenance position | D |
| 3.5.3.1.2 | Centralized database | AD |
| 3.5.3.2 | Status monitoring and control | D |
| 3.5.3.2.1 | Operations status monitoring | D |
| 3.5.3.2.2 | Performance status monitoring | AD |
| 3.5.3.2.2.1 | Performance reporting | D |
| 3.5.3.2.2.1.1 | Reports to maintenance position | D |
| 3.5.3.2.2.1.2 | Reports to MPS | D |
| 3.5.3.2.2.1.3 | Reports to supervisory positions | D |
| 3.5.3.2.2.1.4 | Reports to ACCC | D |
| 3.5.3.2.2.1.5 | Reports to NMCE | D |
| 3.5.3.2.2.2 | Failure logging | D |
| 3.5.3.2.3 | Control | DT |
| 3.5.3.2.3.1 | Failure recovery | DT |
| 3.5.3.2.3.1.1 | Functional recovery | DT |
| 3.5.3.2.3.1.2 | Voice path recovery | DT |
| 3.5.3.2.3.2 | Diagnostic control | D |
| 3.5.3.2.3.3 | Reporting selection control | D |
| 3.5.3.3 | On-line/off-line diagnostics | AT |
| 3.5.3.3.1 | On-line diagnostics | AT |
| 3.5.3.3.2 | Off-line diagnostics | AT |
| 3.5.3.3.3 | Diagnostic interfaces | AT |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.5.3.3.3.1 | Maintenance and supervisory position interfaces | D |
| 3.5.3.3.3.2 | MPS | D |
| 3.5.3.3.3.3 | Remote terminal interface | D |
| 3.5.4.1 | Reconfiguration | DT |
| 3.5.4.1.1 | Characteristics | D |
| 3.5.4.1.1.1 | Configuration | AD |
| 3.5.4.1.1.1.1 | Physical maps | AI |
| 3.5.4.1.1.1.1.1 | Service classmarks | T |
| 3.5.4.1.1.1.1.2 | Physical characteristics | AT |
| 3.5.4.1.1.1.2 | Position maps | AT |
| 3.5.4.1.1.1.2.1 | Operational classmarks | I |
| 3.5.4.1.1.1.2.2 | Communications assignments | AI |
| 3.5.4.1.1.1.3 | Switch maps | AI |
| 3.5.4.1.1.2 | Configuration database | AD |
| 3.5.4.1.1.3 | Reconfiguration levels | A |
| 3.5.4.1.1.3.1 | Position-level reconfiguration | T |
| 3.5.4.1.1.3.2 | Sector-level reconfiguration | D |
| 3.5.4.1.1.3.3 | Area-level reconfiguration | D |
| 3.5.4.1.1.3.4 | Facility-level reconfiguration | D |
| 3.5.4.1.1.4 | Timing Performance | D |
| 3.5.4.1.2 | Reconfiguration initiation | AD |
| 3.5.4.1.2.1 | Reconfiguration initiation by AAS | AD |
| 3.5.4.1.2.2 | Reconfiguration initiation by supervisory positions | AD |
| 3.5.4.1.2.3 | Reconfiguration initiation by maintenance position | D |
| 3.5.4.1.2.4 | Priority of reconfiguration commands | D |
| 3.5.4.1.2.5 | Initiation commands | D |
| 3.5.4.1.3 | Operational sequence | D |
| 3.5.4.1.3.1 | Simultaneous reconfigurations | D |
| 3.5.4.1.3.2 | A/G backup switch reconfiguration | AD |
| 3.5.4.1.4 | Monitor and control | AD |
| 3.5.4.1.5 | Configuration database management | AD |
| 3.5.4.1.5.1 | Database contents | A |
| 3.5.4.1.5.2 | Database size | A |
| 3.5.4.1.5.3 | Map creation | AT |
| 3.5.4.1.5.4 | Map modification | AT |
| 3.5.4.1.5.5 | Map validation | AT |
| 3.5.4.1.5.6 | Database utilities | A |
| 3.5.4.1.5.7 | Database access | AD |
| 3.5.4.1.6 | Recovery processes | AD |
| 3.5.4.1.6.1 | Automatic recovery | AD |
| 3.5.4.1.6.2 | Manual recovery | AD |
| 3.5.4.2 | Traffic data collection, reduction, and analysis | AD |
| 3.5.4.2.1 | Traffic data | AD |
| 3.5.4.2.2 | Traffic data collection | AD |
| 3.5.4.2.2.1 | Voice communications traffic-data collection | D |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.5.3.3.3.1 | Maintenance and supervisory position interfaces | D |
| 3.5.3.3.3.2 | MPS | D |
| 3.5.3.3.3.3 | Remote terminal interface | D |
| 3.5.4.1 | Reconfiguration | DT |
| 3.5.4.1.1 | Characteristics | D |
| 3.5.4.1.1.1 | Configuration | AD |
| 3.5.4.1.1.1.1 | Physical maps | AI |
| 3.5.4.1.1.1.1.1 | Service classmarks | T |
| 3.5.4.1.1.1.1.2 | Physical characteristics | AT |
| 3.5.4.1.1.1.2 | Position maps | AT |
| 3.5.4.1.1.1.2.1 | Operational classmarks | I |
| 3.5.4.1.1.1.2.2 | Communications assignments | AI |
| 3.5.4.1.1.1.3 | Switch maps | AI |
| 3.5.4.1.1.2 | Configuration database | AD |
| 3.5.4.1.1.3 | Reconfiguration levels | A |
| 3.5.4.1.1.3.1 | Position-level reconfiguration | T |
| 3.5.4.1.1.3.2 | Sector-level reconfiguration | D |
| 3.5.4.1.1.3.3 | Area-level reconfiguration | D |
| 3.5.4.1.1.3.4 | Facility-level reconfiguration | D |
| 3.5.4.1.1.4 | Timing Performance | D |
| 3.5.4.1.2 | Reconfiguration initiation | AD |
| 3.5.4.1.2.1 | Reconfiguration initiation by AAS | AD |
| 3.5.4.1.2.2 | Reconfiguration initiation by supervisory positions | AD |
| 3.5.4.1.2.3 | Reconfiguration initiation by maintenance position | D |
| 3.5.4.1.2.4 | Priority of reconfiguration commands | D |
| 3.5.4.1.2.5 | Initiation commands | D |
| 3.5.4.1.3 | Operational sequence | D |
| 3.5.4.1.3.1 | Simultaneous reconfigurations | D |
| 3.5.4.1.3.2 | A/G backup switch reconfiguration | AD |
| 3.5.4.1.4 | Monitor and control | AD |
| 3.5.4.1.5 | Configuration database management | AD |
| 3.5.4.1.5.1 | Database contents | A |
| 3.5.4.1.5.2 | Database size | A |
| 3.5.4.1.5.3 | Map creation | AT |
| 3.5.4.1.5.4 | Map modification | AT |
| 3.5.4.1.5.5 | Map validation | AT |
| 3.5.4.1.5.6 | Database utilities | A |
| 3.5.4.1.5.7 | Database access | AD |
| 3.5.4.1.6 | Recovery processes | AD |
| 3.5.4.1.6.1 | Automatic recovery | AD |
| 3.5.4.1.6.2 | Manual recovery | AD |
| 3.5.4.2 | Traffic data collection, reduction, and analysis | AD |
| 3.5.4.2.1 | Traffic data | AD |
| 3.5.4.2.2 | Traffic data collection | AD |
| 3.5.4.2.2.1 | Voice communications traffic-data collection | D |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.6.11 | VSCS-Weather | AT |
| 3.6.12 | RESERVED | |
| 3.6.13 | VSCS-NMCE | TI |
| 3.6.14 | VSCS-Power | TI |
| 3.6.15 | VSCS-Existing Radio Interfaces | TI |
| 3.6.16 | RESERVED | |
| 3.7.2.1 | Single-point failure | AT |
| 3.7.2.2 | Secondary failure | AT |
| 3.7.2.3 | Redundancy | AT |
| 3.7.2.4 | Reliability program | AT |
| 3.7.3.1 | Maintenance concept | AT |
| 3.7.3.2 | Preventive maintenance (PM) | AT |
| 3.7.3.3 | Mean time to repair (MTTR) | AT |
| 3.7.3.4 | Maintenance requirements | AT |
| 3.7.3.5 | Service and access | AT |
| 3.7.3.6 | Test points | AT |
| 3.7.3.7 | Modules | AT |
| 3.7.3.7.1 | Functional partitioning | AT |
| 3.7.3.8 | Diagnostic requirements | AT |
| 3.7.3.9 | Maintainability program | AT |
| 3.8.1 | Plan | AT |
| 3.8.1.1 | Automatic verification | AT |
| 3.8.2 | BIT/BITE | AT |
| 3.8.2.1 | BIT/BITE functions | AT |
| 3.8.3 | Applicability | AT |
| 3.8.4 | Methodology | D |
| 3.9 | System design and construction | I |
| 3.9.1 | Interchangeability | I |
| 3.9.2 | Dissimilar metals | I |
| 3.9.3 | Service life | AD |
| 3.9.4.1 | Equipment layout | I |
| 3.9.4.1.1 | Equipment room floor space | I |
| 3.9.4.1.2 | Workshop and storage area floor space | I |
| 3.9.4.2 | Module removal and insertion damage | I |
| 3.9.4.3 | Printed circuit assemblies | I |
| 3.9.4.4 | Caoinet and frame construction | I |

Table XVI. Requirements Verification Methods (Cont'd)

| Paragraph | Requirements | Verification Methods |
|---|---|---|
| 3.9.4.4.1 | Cabinet and frame prewiring | I |
| 3.9.4.4.1.1 | Existing on-site console and frame expandability | I |
| 3.9.4.4.2 | Cabinet and frame convenience outlets | I |
| 3.9.4.4.3 | Cable entrance and exit | I |
| 3.9.4.5 | Distribution frames | I |
| 3.9.4.5.1 | Distribution frame cabling | I |
| 3.9.4.5.2 | Test and measurement access and isolation | I |
| 3.9.4.6 | Protector frames | I |
| 3.9.4.7 | Lightning protection | I |
| 3.9.4.8 | Acoustic noise levels | T |
| 3.9.4.9 | Intraconnection and interconnection cables | I |
| 3.9.4.9.1 | Cable connectors | I |
| 3.9.4.9.2 | Cable end terminations | I |
| 3.9.4.9.3 | House cables | I |
| 3.9.4.9.4 | Position cables | I |
| 3.9.4.9.5 | Power cables | I |
| 3.9.4.9.6 | Grounding cables | I |
| 3.9.4.10 | Cabinet ventilation and cooling | T |
| 3.9.4.10.1 | Air filters | I |
| 3.9.4.10.2 | Overheat warning | T |
| 3.9.4.11 | Color and texture of finishes | I |
| 3.9.4.12 | Identification, marking and nameplates | I |
| 3.9.5.1 | Temperature, humidity, and altitude conditions | T |
| 3.9.5.2.1 | Random vibration | T |
| 3.9.5.2.2 | Shock requirements | T |
| 3.9.5.3 | EMC/EMI surveys | T |
| 3.9.5.4 | Electromagnetic interference (EMI) requirements | AT |
| 3.9.5.4.1 | CE03, conducted emissions, narrowband and broadband | AT |
| 3.9.5.4.2 | CS01, conducted susceptibility, power leads | AT |
| 3.9.5.4.3 | CS02, conducted susceptibility, power leads | AT |
| 3.9.5.4.4 | CS06, conducted susceptibility, spikes, power leads | AT |
| 3.9.5.4.5 | RE02, radiated emissions, narrowband and broadband | AT |
| 3.9.5.4.6 | RS03, radiated susceptibility, electric field | AT |
| 3.9.6 | FCC registration | I |
| 3.9.7 | Electrical power | D |
| 3.9.7.1 | VSCS site power | D |
| 3.9.7.2 | VSCS power failure | D |
| 3.9.8 | AC power distribution | D |
| 3.9.9 | Electrical service conditions, transient state | T |
| 3.9.10 | Startup surges | T |

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| 3.9.5.4.3 | CS02, conducted susceptibility, power leads | AT |
| 3.9.5.4.4 | CS06, conducted susceptibility, spikes, power leads | AT |
| 3.9.5.4.5 | RE02, radiated emissions, narrowband and broadband | AT |
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| 3.10.2.4.1 | Unit attributes | AT |
| 3.10.2.4.2 | Special tools and techniques | AI |
| 3.10.2.5 | Use of commercial and reusable software | DI |
| 3.10.2.6 | Software configuration management | DI |
| 3.10.2.7 | Design language, tools, development aids, etc. | DI |
| 3.10.2.7.1 | Program code | I |
| 3.10.3 | Software reliability | AD |
| 3.11.1 | Security | I |
| 3.11.1.1 | Remote access control | I |
| 3.11.2 | Safety | I D |
| 3.12.1 | Operational Redundancy | AD |
| 3.12.2 | Transition Equipment | DT |
| 3.12.3 | Communication System Availability | A |
| 4.2 | Quality Controls | TI |
| 4.2.1 | Hardware quality control program | I |
| 4.2.2 | Software quality control | I |
| 4.2.2.1 | Software stability tests | T |
| 4.2.2.2 | Software stress tests | T |
| 4.3 | RESERVED | |
| 4.4 | RESERVED | |
| 4.5 | Developmental Testing and Analysis | AT |
| 4.6 | Reliability and Maintainability Demonstration Tests | AT |
| 4.6.1 | System reliability demonstration test (includes subparagraphs) | AT |
| 4.6.2 | System maintainability demonstration test (includes subparagraphs) | AT |
| 4.8 | Retest | AT |
| 4.9 | Factory Test | AT |
| 4.9.1 | Design Qualification Tests | AT |
| 4.9.2 | Production Test | AT |
| 4.9.3 | Type Tests | AT |
| 4.10 | Site Acceptance Tests | AT |

Definition of Symbols

A - Analysis
D - Demonstration
T - Test
I - Inspection

Table XVI. Requirements Verification Methods (Cont'd)

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Definition of Symbols

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## 5.2 PACKING

Equipment packed for shipment to another location or to a Depot shall be packed such that it will not be damaged in transit. The equipment shall be checked and suitably packed for heavy components, such as transformers, which may need additional bracing or support to avoid damage in the event the container is dropped during handling.

### 5.2.1 Blocking and Bracing

Unless otherwise secured, items that do not completely fill the container shall be blocked and braced to prevent movement inside the container. Items having projecting parts that are subject to damage or that would tend to damage the barrier media shall be rigidly supported. Blocking or bracing shall be applied against areas of the items that are of sufficient strength and rigidity to resist damage. Distribution of supports to several points or to a large area of the item shall be provided. Ends of wood blocks or braces shall not be fastened to a wood container by end-grain nailing, toe nailing, or similar methods. They shall be fastened to sturdy parts of areas of the container, or held in grooves formed by parallel cleats or securely socketed.

### 5.2.2 Cushioning

Cushioning materials (or devices) shall be used to protect the contents and the preservation and packaging components from physical damage. The cushioning medium shall be placed as close to the items as practicable to prevent flexible barrier rupture or to ensure against free movement in rigid containers.

### 5.2.3 Bolting

Items such as subassemblies, having bolt holes in part of the item that is sturdy enough to resist breakage when handled roughly, shall, if practical, be bolted to one face of the container. In instances involving nonprecision bolt holes, the diameter of the bolt shall be the nearest standard size consistent with the diameter of the hole. In instances involving precision bolt holes, precaution shall be taken to ensure precision fitting bolts of proper characteristics to prevent marring or elongation; lag screws or lag bolts shall not be used. Holes bored through containers or mounting bases shall be the same size as the diameter of the bolt used. When container bases are provided with skids, the bolts shall extend through the skids whenever practical, and the bolts countersunk in the outer surface of the skid.

5.2.3.1 Securing Bolts - Standard cut washers shall be used under nuts to contact with wood. To ensure that the nuts will not come loose in transit, they must be positively secured by applying asphaltum, paint, or lacquer on the threads; by use of lock nuts; or by use of cotter pins with nuts. Bolts and nuts without corrosion-resistant finish shall, prior to use, be completely covered with a corrosion-preventive compound.

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markings, shall be in accordance with MIL-STD-129.

5.2.9 Packing List

Each individual shipping container, 'or one container of each shipment, shall contain a packing list showing in detail a complete description and quantities of each item in the shipment. When the packing list is enclosed in one container of the group, that container shall be clearly marked "PACKING LIST INSIDE." It is also permissible to place the packing list in a heavy envelope marked "PACKING LIST," and securely fasten it to one of the containers. The packing list shall contain the following minimum information:

a. Unit names(s),
b. Part number(s),
c. Serial number(s),
d. Manufacturer,
e. Shipping number,
f. Date packed,
g. Originating location,
h. Destination.

5.3 SHIPMENT

Shipment of all material and equipment required for VSCS installation at any site shall be the responsibility of the contractor including off-loading and emplacement of equipment. Shipment of VSCS equipment from the contractor's plant to a specific site within the continental limits of the United States shall be by a padded electronic-equipment-type moving van.

6.0 NOTES

## 6.1 NOTE ON INFORMATION ITEMS

The contents of this section are for information for the initiator of the procurement request only and are not a part of the requirements of this specification. They are not contractor requirements nor binding on either the FAA or the contractor. In order for these terms to become a part of the resulting contract, they must be specifically incorporated in the schedule of the contract. Any reliance placed by the contractor on the information in these paragraphs is at the contractor's own risk.

APPENDIX I

## 10.0 ACRONYMS, ABBREVIATIONS, DEFINITIONS, TERMS, AND FORMULAS

### 10.1 ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| MS | Advanced Automation System |
| ACCC | Area Control Computer Complex |
| ACF | Area Control Facility |
| A/G | Air/Ground |
| ARTCC | Air Route Traffic Control Center |
| ATC | Air Traffic Control |
| ATIS | Automated Terminal Information Service |
| AWACS | Airborne Warning and Control System |
| BIT | Built-In Testing |
| BITE | Built-In Test Equipment |
| BITS | Built-In Test Sequences |
| BSTR | Bell System Technical Reference |
| BUEC | Backup Emergency Communications |
| CA | Common Answer |
| c/c | Common Console |
| CDR | Critical Design Review |
| CDRL | Contract Data Requirements List |
| CFCF | Central Flow Control Facility |
| CM | Configuration Management |
| CMP | Configuration Management Plan |
| csc | Computer Software Component |
| CSCI | Computer Software Configuration Item |
| CSDM | Computer System Diagnostic Manual |
| CSOM | Computer System Operator's Manual |
| DA | Direct Access |
| DBDD | Database Design Document |
| DT&E | Developmental Testing and Evaluation |
| ED | Entry Device |
| E E E | Electrical, Electronic, and Electromechanical |
| EIA | Electronic Industries Association |
| EMC | Electromagnetic Compatibility |
| EM1 | Electromagnetic Interference |
| ESS | Environmental Stress Screening |
| FAA | Federal Aviation Administration |
| FCA | Functional Configuration Audit |
| FCC | Federal Communications Commission |
| FPA | Fix Posting Area |
| FRACAS | Failure Reporting, Analysis, and Corrective Action System |
| FTS | Federal Telecommunications System |
| GFE | Government-Furnished Equipment |
| G/G | Ground/Ground |
| GMT | Greenwich Mean Time |
| GOES | Geostationary Operational Environmental Satellite |

| | |
|---|---|
| HOL | High-Order Language |
| HS | Headset |
| HS/LS | Headset/Loudspeaker |
| H/W | Hardware |
| IA | Indirect Access |
| IC | Intercom |
| I C D | Interface Control Document |
| ICSS | Integrated Communication Switching System |
| ID | Identification |
| IDD | Interface Design Document |
| IDF | Intermediate Distribution Frame |
| IG | Independent Group |
| I/O | Input/Output |
| IP | Interphone |
| IRD | Interface Requirement Documents |
| IRS | Interface Requirements Specification |
| ITT | Independent Test Plan and Test Procedure |
| LRU | Line Replaceable Unit |
| LS | Loudspeaker |
| MBRT | Mean Bench Repair Time |
| MCE | Monitor and Control Equipment |
| MDF | Main Distribution Frame |
| MIL-STD | Military Standard |
| MPS | Maintenance Processor System |
| MRB | Material Review Board |
| M/S | Main/Standby |
| MTBCF | Mean Time Between Critical Failures |
| MTBF | Mean Time Between Failures |
| MTBPMA | Mean Time Between Preventive Maintenance Actions |
| MTBUMA | Mean Time Between Unscheduled Maintenance Actions |
| MTTR | Mean Time to Repair |
| NAS | National Airspace System |
| NBS | National Bureau of Standards |
| NMCE | Monitor and Control Equipment |
| NUREG | Nuclear Regulatory Commission |
| OCD | Operational Concept Document |
| ORD | Operational Readiness Date |
| OVR | Override |
| PABX | Private Automatic Branch Exchange |
| PBH | Peak Busy Hour |
| PBM | Peak Busy Minute |
| PCA | Physical Configuration Audit |
| PCS | Power Conditioning System |
| PCSDM | Preliminary Computer System Diagnostic Manual |
| PCSOM | Preliminary Computer System Operator's Manual |
| PDL | Program Design Language |
| PDR | Preliminary Design Review |
| PIDD | Preliminary Interface Design Document |
| PM | Preventive Maintenance |

| | |
|---|---|
| HOL | High-Order Language |
| HS | Headset |
| HS/LS | Headset/Loudspeaker |
| H/W | Hardware |
| IA | Indirect Access |
| IC | Intercom |
| I C D | Interface Control Document |
| ICSS | Integrated Communication Switching System |
| ID | Identification |
| IDD | Interface Design Document |
| IDF | Intermediate Distribution Frame |
| IG | Independent Group |
| I/O | Input/Output |
| IP | Interphone |
| IRD | Interface Requirement Documents |
| IRS | Interface Requirements Specification |
| ITT | Independent Test Plan and Test Procedure |
| LRU | Line Replaceable Unit |
| LS | Loudspeaker |
| MBRT | Mean Bench Repair Time |
| MCE | Monitor and Control Equipment |
| MDF | Main Distribution Frame |
| MIL-STD | Military Standard |
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| NAS | National Airspace System |
| NBS | National Bureau of Standards |
| NMCE | Monitor and Control Equipment |
| NUREG | Nuclear Regulatory Commission |
| OCD | Operational Concept Document |
| ORD | Operational Readiness Date |
| OVR | Override |
| PABX | Private Automatic Branch Exchange |
| PBH | Peak Busy Hour |
| PBM | Peak Busy Minute |
| PCA | Physical Configuration Audit |
| PCS | Power Conditioning System |
| PCSDM | Preliminary Computer System Diagnostic Manual |
| PCSOM | Preliminary Computer System Operator's Manual |
| PDL | Program Design Language |
| PDR | Preliminary Design Review |
| PIDD | Preliminary Interface Design Document |
| PM | Preventive Maintenance |

| | |
|---|---|
| VSCS | Voice Switching and Control System |
| V&V | Verification and Validation |
| WECO, WE | Western Electric Company |
| WECO 300/301 | Four-wire telephone key systems employed at large ATC facilities |
| WWVB | The National Bureau of Standards radio station located at Fort Collins, Colorado (latitude 40 degrees, 41' 28.3"N; longitude 105 degrees, 02' 39.5"W), broadcasting on a carrier frequency of 60 kHz |
| XTS | External Time Source |
| OTLP | Zero Transmission Level Point |

## 10.2 DEFINITION AND TERMS

**Action, Continuous Touch** - A manual operation at the VSCS human/system interface which initializes and uses certain communication circuits and VSCS controls that are activated for the duration of the continuous touch action, and deactivated with the cessation of the continuous touch action.

Action, Single Touch - An operation that occurs at the VSCS human/system interface which affects communication circuits and VSCS controls in one of two ways: (1) momentary-to-make (latch or enable), and (2) momentary-to-break (unlatch or disable).

Active Call or Position Active Call - A call (placed or received) under the control of position operator, and to which they are conversant.

Active Position - An operable controller position functioning with respect to a configuration map.

Active Sector - A sector in which air traffic control is provided in one or more assigned fix posting areas.

Address:

a. A character or group of characters that identifies a register, a specific part of storage, or some other data source or destination,

b. To refer to a device or an item of data by its address.

**Advanced** Automation System **(AAS)** - A system of four computer complexes that support air traffic control. The four computer complexes are:

a. Area Control Computer Complex (ACCC) at ARTCC and ACF,

b. Tower Control Computer Complex (TCCC) at ATCT,

c. System Support Computer Complex (SSCC) at FAATC,

d. Research and Development Computer Complex (RDCC) at FAATC.

Air Traffic Control Position - A common console configured for en route or terminal air traffic control activities.

Air Traffic Controller - A person authorized to provide air traffic service including en route and terminal approach control.

Ancillary Position - A common console configured for non-air traffic control activities including:

a. Area Manager,
b. NAS Manager
c. Area Supervisor,
d. Traffic Management,
e. En Route Metering,
f. Military Operations Specialist,

g. Weather Coordinating,
h. Automation Specialist,
i. Flight Data Communications Specialist,
j. Center Weather Service
k. Oceanic DAPS,
l. Airborne Warning and Control System,
m. Aircraft Movement Information,
n. Maintenance.

Area Control Computer Complex (ACCC) - That computer complex (hardware and software) of the AAS which provides continuous real-time support of air traffic control of an area assigned to an ACF.

Area Control Facility - A building at which en route and terminal air traffic control is provided and supported by an ACCC.

Area-Level Reconfiguration - Reconfiguration affecting an area's communications and functional capabilities.

Area Map - A correspondence set wherein the communications assignments and control capabilities of an area (predetermined sets of sector suites) within a facility are defined. A correspondence set between the physical maps and configuration maps of grouped sector suites (see Switch Map).

Assembly - A number of parts or subassemblies or any combination thereof joined together to perform a specific function and capable of disassembly.

Assign - A VSCS configuration action that provides specific A/G, G/G communication connectivity capabilities and other communication feature capabilities to air traffic control and ancillary positions.

Assigned Frequency - A frequency in an air traffic control position map made available for use at a position. Frequency assignment implies only the availability of the transmitter and receiver to the position.

Background Mode - In a multi-program-system, the condition under which low-priority programs are executed. The execution of data processing operations that are secondary to real-time voice switching and control.

Background Noise - Noise level present on a connected voice circuit..

Backup - Provision for an alternate means of operation in case the primary means is not available.

**Back up** - The act or process of making a backup.

BUEC (Backup Emergency Communications) - A secondary backup A/G communications network that is independent of primary A/G communications transmission paths and equipment. BUEC is not the same as the backup A/G switch.

Busy - A condition that exists when a called position has an active call in progress and a full CA queue. A call processing tone that is generated when the above condition exists at a called position (G/G only).

**Call** - A demand to set up a communication connection.

Call Features - Call forwarding, call monitoring, supervisory recording, headset or loudspeaker call routing, call queuing with caller identification, etc. Types of calls are made in certain modes with certain features invoked; for example. an interphone (type), indirect access (mode), override (feature) call that is monitored (feature) and recorded (feature) by the calling party's supervisor.

Call Forwarding - A switch-provided call feature that permits the user to instruct the switching equipment to redirect G/G calls destined for one position to an alternate position.

**Call Modes** - Direct access, indirect access, and voice call (G/G only).

Call Transfer - A switch-provided call feature that allows a user to redirect a G/G call that has either been answered or that is in the CA queue at a given position to another position.

**Call Types** - Intercom and interphone (G/G only).

Calling Line Identification or Caller ID - A switch-provided feature whereby a call source is automatically identified to the called position.

Catastrophic Failure - Failure that is both sudden and complete.

Channel - A communication path providing one-way or two-way transmission between two terminations.

Circuit - (1) A network providing one or more closed paths. (2) An interconnection of electrical/electronic elements. (3) A conductor or system of conductors through which an electrical current is intended to flow.

Classmark - An object program code that enables or disables access to VSCS services and functions. A service classmark enables or disables the class of service with respect to a trunk circuit, mainly its signaling as defined by an Interface Control Document (ICD). An operational classmark enables or disables position access to VSCS communication capabilities.

Common Answer - A switching function whereby certain G/G calls incoming to a position are directed to a queue to be selectively answered by the position user (also known as automatic call parking).

**Common** Console - A **standardized,** human-engineered equipment cabinet including a work surface with provision for physical devices including: main display, interactive display, data entry keyboard, keypad, communications jacks, loudspeakers, and VSCS panel. Various configurations of physical.devices provide for air traffic control and ancillary activities.

Complete **Failure** - Failure resulting from deviations in characteristics beyond specified limits such as to cause complete lack of the function.

Configuration - The arrangement of a computer system or network as defined by the nature, number, and the chief characteristics of its functional elements. The functional or physical characteristics (or both) of systems hardware/software.

Configuration Map - A correspondence set between VSCS hardware elements and

Call Features - Call forwarding, call monitoring, supervisory recording, headset or loudspeaker call routing, call queuing with caller identification, etc. Types of calls are made in certain modes with certain features invoked; for example. an interphone (type), indirect access (mode), override (feature) call that is monitored (feature) and recorded (feature) by the calling party's supervisor.

Call Forwarding - A switch-provided call feature that permits the user to instruct the switching equipment to redirect G/G calls destined for one position to an alternate position.

**Call Modes** - Direct access, indirect access, and voice call (G/G only).

Call Transfer - A switch-provided call feature that allows a user to redirect a G/G call that has either been answered or that is in the CA queue at a given position to another position.

**Call Types** - Intercom and interphone (G/G only).

Calling Line Identification or Caller ID - A switch-provided feature whereby a call source is automatically identified to the called position.

Catastrophic Failure - Failure that is both sudden and complete.

Channel - A communication path providing one-way or two-way transmission between two terminations.

Circuit - (1) A network providing one or more closed paths. (2) An interconnection of electrical/electronic elements. (3) A conductor or system of conductors through which an electrical current is intended to flow.

Classmark - An object program code that enables or disables access to VSCS services and functions. A service classmark enables or disables the class of service with respect to a trunk circuit, mainly its signaling as defined by an Interface Control Document (ICD). An operational classmark enables or disables position access to VSCS communication capabilities.

Common Answer - A switching function whereby certain G/G calls incoming to a position are directed to a queue to be selectively answered by the position user (also known as automatic call parking).

**Common** Console - A **standardized,** human-engineered equipment cabinet including a work surface with provision for physical devices including: main display, interactive display, data entry keyboard, keypad, communications jacks, loudspeakers, and VSCS panel. Various configurations of physical.devices provide for air traffic control and ancillary activities.

Complete **Failure** - Failure resulting from deviations in characteristics beyond specified limits such as to cause complete lack of the function.

Configuration - The arrangement of a computer system or network as defined by the nature, number, and the chief characteristics of its functional elements. The functional or physical characteristics (or both) of systems hardware/software.

Configuration Map - A correspondence set between VSCS hardware elements and

message weighting network.

**dBrn** - A logarithmic measure of power with respect to a reference power of one picowatt (-90 **dBm**), used for noise tests.

0 **dBm** = 90 **dBrn** or **dBrn** = (10) log (P/O-12 Watt)

**dBrnC** - A logarithmic measure of power relative to a noise reference of -90 **dBm** as measured with a noise meter weighted by a special frequency function called C-Message Weighting. The interfering effect of noise given in **dB** above a noise reference of -90 **dBm** at 1.0 **kHz** measured with a C-message filter.

**dBrnC0** - Noise measured in **dBrnC** and referred to the OTLP.

Decibel **(dB)** - A logarithmic measure of the ratio **between two** powers.

dB = (10) x log (P2/P1)

Degradation Failure - **Failure that** is both gradual and partial.

Deselect - An action at an ATC or ancillary position touch entry device or interactive display that results in the deactivation of an A/G communication connectivity at that position.

Deselection - Causing the state of a selected feature of the VSCS to change to not selected.

Designator - A name, entitlement, or distinctive mark intended to point out, assign, indicate, or specify.

Direct Access - A call mode wherein the entire call processing sequence required to establish circuit connectivity is accomplished as the result of a single touch action (G/G only).

Disable - The deactivation of the communication connectivity between the VSCS and the RCE as a result of a DESELECT (A/G only). The deactivation of any VSCS feature or control function.

Disabled Receiver - A receiver, either main or standby, for a selected frequency at an air traffic control position which the position operator has **indicated** will not be used for the reception of voice at the position. Disabling a receiver at a position does not affect its enabled or disabled status at any other operational position. Equivalent to locally muting the receiver.

Disabled Transmitter - A transmitter, either main or standby, for a selected frequency at an air traffic control position which the position' operator has indicated will not be used for transmission of voice from the position. Disabling a transmitter at a position does not affect its enabled or disabled status at any other operational position.

Electronic Patch Panel - Provides a capability of remote access for the purpose of testing and monitoring individual or grouped VSCS voice paths.

**E&M** - A signaling method for transferring supervisory and control

information over a trunk circuit using the signal circuits "E" and "M" leads. The "E" lead transmits into the trunk circuit and the "M" lead transmits into the signal circuit.

Emergency Frequency - See Guard Frequency.

Enable - The activation of the communication connectivity between the VSCS and the RCE as a result of SELECT (A/G only). The activation of any VSCS feature or control function.

Enabled Receiver - A receiver, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will be used for the reception of voice at the position. Enabling a receiver at a position does not affect its enabled or disabled status at any other operational position.

Enabled Transmitter - A transmitter, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will be used for the transmission of voice from the position. Enabling a transmitter at a position does not affects its enabled or disabled status at any other position.

Erlang - A unit of telephone switch traffic intensity measured in number of arrivals per mean service time. For carried traffic measurements, the number of erlangs is the average number of simultaneous connections observed during a measurement period.

Facility Backup - The act or process of backing up a failed ACF by expanding the controlled sectors of adjacent ACFs to encompass the control sectors of the failed ACF with respect to navigation, surveillance, control and advisory voice and data communications necessary for continued safe air traffic control. Facility backup lies in the AAS/ACCC control domain.

Facility-Level Reconfiguration - A change of communication assignments and control capabilities wherein the modification or changeover occurs with respect to facility maps (also see Facility Backup and Reconfiguration).

Facility Map - A correspondence set wherein the communications assignments and functional capability of an entire facility are defined. A correspondence set between the physical maps and the configuration maps of all sector suites.

Fail Soft - If a failure occurs, that failure will not disrupt the entire system. There may be degradation of service, but basic service will continue.

Fail Soft/Fail Safe - A designed property of an item which prevents its failures being critical failures.

Federal Telecommunications System (FTS) - A leased communications service for use by the U.S. Government.

First Article System - A prototype system upgraded after production award.

First Production System - The initial production equipment.

Fix Posting Area - A volume of airspace, bounded by a series of connected

line segments with altitudes, which is assigned to a sector.

Flashing - A visual signal interrupted 60 times per minute with a 50:50 on:off ratio.

Fluttering - A visual signal interrupted 720 times a minute with an 80:20 on:off ratio.

Foot Candle - The illumination on a surface 1 foot square on which there is a uniformly distributed flux of 1 lumen.

Foot Lambert - Photometric brightness equal to that of a perfectly diffusing surface emitting or reflecting light at the rate of 1 lumen per square foot.

Frequency - A part of the radio spectrum used by the FAA to carry communications between controllers and pilots. The spectrum contains ultra-high (used for military air traffic) and very high frequencies (used for civilian traffic).

Frequency Allocation - Designated radio frequency bands for use by specific radio services. Air traffic control frequency allocations used by the FAA are:

118.000 MHz to 135.975 MHz for civilian aircraft
225.0 MHz to 399.95 MHz for military aircraft

Frequency Pair - A combination of VHF and UHF frequencies used as a single radio communication channel.

Full Image - Pertaining to a disk or tape; a faithful likeness of the subject matter on the original.

Functionality - One or more equipments whose configuration provides the capability to perform specified activities.

Functional Path - The set of physical items/equipments necessary to initiate, sustain, and terminate operation of a given function (e.g., radio, IC, or IP).

Grade of Service - The proportion of total calls, usually during the peak busy hour, which cannot be completed immediately or served within a prescribed time.

Gradual Failure - Failure that could be anticipated by prior examination or monitoring.

Guard Frequency - A designated point in the radio spectrum to which radio equipment is kept tuned expressly to monitor for and to make emergency broadcasts. The FAA Radio service uses 121.50 MHz and 243.0 MHz as guard frequencies.

Handoff - Turning over air traffic control of an aircraft from a controller of one sector to another controller of an adjacent sector or terminal.

Handoff Function - Turning over control of an aircraft to another controller or facility.

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at the operational position activating the muting function for selected frequencies.

Lockout - The inability of one or more users to initiate voice transmission on a given circuit because that circuit is already enabled or in use (see Push-to-Talk).

Logical Map - Map that defines position identification for communications connectivity independent of the position's physical address.

Loop-Back Testing - A standard telephone test procedure involving accessing the circuit at any test access point and sending test signals down the line. The test signals are returned (looped back) to the test access point where diagnostics are then performed on the returned test signals. The loop-back points are located progressively further away from the test access point until either the fault has been detected or the entire circuit has been tested.

Main Distribution Frame - A distributing frame used to terminate leased and Government-owned long-line facilities on the one side and cable pairs for line and trunk equipment terminals associated with a switching system on the other side. The main distribution frame is the interface point used for associating any outside line or trunk with any desired equipment terminal or with any other outside line or trunk. It usually serves as a test point between in-house and outside plant cabling.

Main (or Standby Units) - Units that are operationally critical and are redundantly integrated into the system to achieve a high degree of reliability.

Maintenance Position - The VSCS maintenance workstation (also see Ancillary Position).

MALF - Malfunction signal from BUEC.

Man/Machine Interface - (Pertaining to station control and data acquisition). The operator contact with equipment governed by ANSI IEEE C37. MIL-STD-1472 is recommended as a reference for use in the design and evaluation of the man/machine interface.

Manual Ring - A selective signaling arrangement that consists of a manual ring, generated by the calling party, to alert a specific station on a multidrop circuit in which all stations receive the ringing signal.

Map - To establish a correspondence between the elements of one set and the elements of another set. A correspondence set between elements of one set and elements of another.

Mean Talker Level - Specified at -13.9 dBm0, which is 0.9 dBm less than the maximum voice frequency (VF) signal (average more than 3 seconds) on a standard VF channel and 2.1 dBm more than the VF channel interface standard.

Meet-Me Conference - A conference call in which parties desiring to enter a (pre-arranged) conference call do so by individually accessing the conference feature (e.g., a conference bridge).

Mode - A possible, customary, or preferred way of doing something.

Modular - The extent to which hardware/software is composed of discrete components such that a change to one component has minimal impact on other components.

Module - A limited aggregate of LRUs, data, and contiguous codes that performs independent functions. Typically, modules are used repeatedly in the construction of the system.

Monitor - To listen in on the communications of another controller.

Multiple - Providing more than one connection at a common point.

Multi-point Trunk - A dedicated trunk shared by three or more positions at two or more facilities.

Multi-position Sector - A sector whose control involves the use of more than one common console; typically, it will use two or three adjacent consoles.

Muting - The capability to eliminate receiver output volume on selected air/ground channels.

Muting, Local - See Local Muting.

Muting, Remote - See Remote Muting.

Nonlatching - A feature which either is or emulates a pushbutton that requires an operator to provide continuous touch action to maintain the desired pushbutton activation. The activation is terminated by the release of touch action on the pushbutton.

Off-Hook - One of several line/trunk supervisory signals. Normally a line/trunk state change of idle-to-off indicates a request for service.

Off-Line - (1) An operating condition wherein human action is required between the original recording functions (data recording and storage) and the ultimate data processing functions, including conversion operations, and loading/unloading operations incident to the use of point-to-point or data gathering systems. (2) The operations of a functional unit that are not under the continuous or automatic control of a central or main processing unit.

On-Line - (1) An operating condition wherein input data enters the system directly from the point of origin or in which output data is transmitted directly to where it is used. (2) The operations of a functional unit that are under continuous control of a central or main processing unit.

Operational Configuration - Hardware, communications, functional assignments, and connectivity currently in effect in VSCS.

Operating Position - A manned active position.

Operational Position - A position defined within a configuration.

Mode - A possible, customary, or preferred way of doing something.

Modular - The extent to which hardware/software is composed of discrete components such that a change to one component has minimal impact on other components.

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Operational Configuration - Hardware, communications, functional assignments, and connectivity currently in effect in VSCS.

Operating Position - A manned active position.

Operational Position - A position defined within a configuration.

Preset Conference - Same as progressive conference except that conferees will be called automatically by the system when the conference call is requested.

Program Control - The interaction between the software and the hardware of the switching system which determines the time and sequence in which processing occurs. The relationship between a set of instructions and the electronics incorporated into the design of the switching system which enables that system to recognize and perform tasks by interactive user commands or without further intervention by a system user.

Progressive Conference - A conference call in which conferees are successively added to the conference, up to the conference limit, at the discretion of a calling party.

Prototype System - A pre-production model.

PTT Lockout - Condition arising when an attempt is made to transmit on a frequency that is already being used. Transmission will not be permitted to the attempting position unless PTT preemption has been for that frequency.

PTT Preemption - A classmarked capability for a frequency at a position whereby PTT activation from that position will cause seizing of the frequency, locking out all other attempted users including the user just previous to PTT (preemption) activation.

Pulsing - The signaling over the communication path of signals representing one or more address digits required to set up a call.

Pushbutton Action or Pushbutton Operation - The selection of an operation, function, or process by pressing or touching a function key or some display group representing a function key. Pushbutton operation, although in existing equipment refers to the operation of a mechanical switch, has a broader meaning to include such state-of-the-art controls as touch membrane, capacitance touch, touch-entry standards and to meet the reliability/maintainability requirements of this document.

Push-to-Talk (PTT) - A method of communication over a speech channel in which transmission occurs 'in only one direction at a time; while talking the talker is required to keep a switch activated (continuous touch action).

Real Time Quality Control (RTQC) - Real time quality control is the on-line capability of.fault detection, isolation, and reporting in real time.

**Receiver** - Equipment that picks up radio signals sent by transmitters.

Reconfiguration - A change of communication assignments and control capabilities through the modification of the invoked configuration map or through a changeover from one map to another. Reconfiguration can take place at the position, sector, area, and facility levels.

Remote Override - The capability to provide override between two independent systems, VSCS to/from TCS.

Remote Muting - Muting of receivers for selected frequencies. The VSCS will not receive voice from the RCE interface for frequencies on which the

remote muting function has been activated.

Resectorization - Redefining and restructuring sectors and the creation of new sectors to support the establishment of new airways and changing traffic patterns.

Return Loss - The return loss at an impedence discontinuity on a two-wire line is the ratio, expressed in decibels, of the level of incident signal to that of its reflected signal. The return loss on a four-wire line is the insertion loss measured between transit and receive pairs with the far end terminated as specified. Echo return loss is a weighted average (on a power basis) of the return loss at all frequencies in the range 500 to 2500 Hz. Single-frequency return loss is the lowest non-weighted return loss in the 0.2- to 3.2- kHz band.

Ringback - A tone that indicates to a caller that a ringing signal is being applied to a called station.

Sector - A volume of airspace, bounded by a series of connected line segments with altitudes defined for the purpose of assigning responsibility for control of aircraft in the airspace (also see Control Sector).

Sector Airspace - One or more contiguous fix posting areas controlled from a single control sector (i.e., the FPAs assigned to a control sector). The sector airspace may overlie or underlie airspace controlled by another sector.

Sector Area - See Sector Airspace.

Sector Combining - Combining of more than one sector's communications assignments and functional capabilities at one or more sector suites.

Sector Decombining - Distributing of combined sector communications assignments and functional capabilities among sector suites.

Sector-Level Reconfiguration - A change of ATC communications assignments and control capabilities wherein the modification or changeover occurs with respect to sector maps.

Sector Map - A correspondence set wherein the communications assignments and functional capabilities of all positions in a sector suite are defined. A correspondence set between the physical maps and the configuration maps of all positions in a sector suite (also see Switch Map).

Sector Suite - A collocated set of one to five common consoles equipped with appropriate sets of data entry and display devices. The set is assigned to one or more controllers working a control sector.

Sector Suite Common Console - Physically identical position workstations within a sector suite which contain the VSCS common console equipment as a primary component.

Select - An action at an ATC or ancillary position touch entry device or interactive display which results in the activation of an A/G communication connectivity at that position.

Selected Frequency - One of an air traffic controller's assigned frequencies which the position operator has indicated will be included in the set of currently operational frequencies to be used for transmission and reception at the position. Connectivity of the transmitter and receiver has been confirmed.

Selective Mode Operation - In this mode, a VHF and UHF assigned to a sector are combined on one trunk. The controller may select VHF only, UHF only, or select both frequencies simultaneously. Using this system, a controller keying one frequency (VHF or UHF) denies the other frequency (UHF or VHF, respectively) to another controller.

Sender - Equipment that generates and transmits signals in response to information received from another part of the system.

Service Circuits - Those time-shared circuits of the system which achieve a desired grade of service. The failure of one or several will not make the system inoperative, but may degrade the service during peak load.

Service F - A communications service comprised of dedicated circuits leased by the FAA.

Sidetone - The acoustic signal resulting from a portion of the transmitted signal being coupled to the receiver.

Single Point Failure - A failure of a single item which has the effect of failing an entire function or functionality.

Signaling - With respect to telephone switching systems; the transmission of address and other switching information between stations and central offices, stations and switching entities, and between switching entities.

Site - Any location where equipment is to be supplied or installed.

Sound Pressure Level (SPL) - An acoustical intensity expressed in decibels above a reference level of 0.0002 dyne/cm to the second power.

Split Mode Operation - The VHF and UHF frequencies of the sector are carried on two different trunks. Thus, there is no contention; PTT lockout affects only the selected frequency.

Standard - Regularly and widely used, available, or supplied; definite rule for measurement of quantity, weight, extent, value, or quality as established by authority.

Subassembly - Two or more parts that form a portion of an assembly or a unit replaceable as a whole, but having part or parts that are individually replaceable.

Subsystem - A combination of sets, groups, etc., that performs an operational function within a system and is a major subdivision of the system.

Sudden Failure - Failure that could not be anticipated by prior examination or monitoring.

Supervisory Position - The workstation for first line supervisor who is

Selected Frequency - One of an air traffic controller's assigned frequencies which the position operator has indicated will be included in the set of currently operational frequencies to be used for transmission and reception at the position. Connectivity of the transmitter and receiver has been confirmed.

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Standard - Regularly and widely used, available, or supplied; definite rule for measurement of quantity, weight, extent, value, or quality as established by authority.

Subassembly - Two or more parts that form a portion of an assembly or a unit replaceable as a whole, but having part or parts that are individually replaceable.

Subsystem - A combination of sets, groups, etc., that performs an operational function within a system and is a major subdivision of the system.

Sudden Failure - Failure that could not be anticipated by prior examination or monitoring.

Supervisory Position - The workstation for first line supervisor who is

Turnkey - Complete single responsibility from start to the point of turning over the final system, ready for operational use.

Type - A particular kind, class, or group.

Type Test - Tests performed to verify that the equipment or system performs over the range of specified service conditions.

Unit'- An assembly or any combination of parts, subassemblies, and assemblies mounted together, normally capable of independent operation in a variety of situations.

Utility Program - A computer program in general support of the processes, of'computer, e.g., loading, shorting, trace routines, or copying data from one storage device to another.

Voice Call - A call mode wherein initial circuit connectivity is always to the loudspeaker at the called position. Prior to answering, the called party must switch the connection (single touch action) to his or her headset. Voice calling is an overlay mode, that is, it can be used in conjunction with direct access or indirect access modes. Also known as group alerting.

Voice Call Circuit - A special connectivity path for processing voice calls to selected loudspeakers.

VSCS Console Equipment - The complement of VSCS position equipment consisting of the VSCS position equipment consisting of the VSCS position electronics box, the indirect access keypad and interactive display unit(s) (panel(s)).

VSCS Interactive Display Panel - A physical device that provides display and control access to the user.

VSCS Numbering Plan - A uniform numbering system wherein all positions with VSCS display panels in an ARTCC/ACF have unique designations similar in form to those of all other ARTCCs/ACFs connected to the NAS Integrated Communication System.

WINKING - A visual signal interrupted 60 times per minute with a 95:5 on:off ratio.

Zip Tone - A 0.2-second burst of dial tone.

## I 10.3 RMA DEFINITIONS

Inherent Availability, A (subscript i)--A measure (probability) of the degree to which an item (system) is in an operable and committable state at the start of a mission, when the mission is called for at an unknown (random) time.

$$A_i = \frac{MTBCF_s}{MTBCF_s + MTTR_s}$$

where

A (subscript i) = inherent (designed in) availability

MTBCF(subscript s) = mean time between critical failures for the system

MTTR(subscript s) = mean time to repair for the system

Operational Availability, A (subscript o) - The proportion of time a system is either operating or is capable of operating, when used in a specific manner in a typical maintenance and supply environment. This definition of availability is suitable for defining logistics design goals and scoring methods in field trails. There are two forms of this logistic measurement model shown below; the VSCS analysis should use the form given in (b).

a. The theoretical model, for an ideal reporting environment where all records are kept for all needed measurements, is given as:

$$A_o = \frac{\text{All time when system is operable or operating}}{\text{Total calendar time that readiness was required of a system under control of the operating organization (or possessed time)}}$$

$$= \frac{OT + ST}{OT + ST + TCM + TPM + TALDT}$$

where

OT = total operating time (unit hours) per system

ST = standby time (system is operational, but not in use)

TCM = total corrective maintenance time per system (including diagnostics)

TPM = total preventive maintenance time

TALDT = total administrative and logistics delay time

b. The more realistic version for operational availability is given below:

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TCM = total corrective maintenance time per system (including diagnostics)

TPM = total preventive maintenance time

TALDT = total administrative and logistics delay time

b. The more realistic version for operational availability is given below:

Single-Point Failure - A failure of a single item that has the effect of failing an entire functionality.

## 10.4 SYSTEM FAILLURE

Operational Mission Failure - Any incident or malfunction of the system, excluding software defects, which the ATC controller/maintenance crew cannot remedy or repair or reconfigure using the controls, authorized test equipment and tools within a specified time, and which causes one or more of the following:

a. Inability to continue, commence, or cease operation,

b. Inability to accomplish any of the mission-essential functions,

c. Loss of any process essential to any function even though not essential to the specific mission in progress,

d. A critical or catastrophic hazard to personnel or equipment as defined by MIL-STD-882A, 28 June 1977,

e. Loss of mission-essential functions caused by improper operating or maintenance instructions or inadequate test, measurement and diagnostic equipment (TMDE) or support equipment.

Unscheduled Maintenance Actions - Any malfunction which is either an operational mission failure or results in any unscheduled corrective maintenance action. All operational mission failures are considered unscheduled maintenance actions even if negligible time is actually required for corrective maintenance.

Mission Essential Functions - Functions that the system must be capable of performing in order to accomplish its mission tasks in an acceptable manner.

Equipment or Item - Equipment or item failure is when any part of an item does not par-form as required by its performance specification after it has been installed and determined to be operable prior to the event.

Redundancy Switching Time - The time interval between item (d) failure occurrence and the moment when the redundant item(s) is operable.

Preventive Maintenance (PM) - All actions performed in an attempt to retain an item in a specified condition by providing systematic inspection, detection, and prevention of incipient failures. Preventive Maintenance is synonymous to Periodic Maintenance.

a. System non-interrupting PM--PM that does not degrade system operational effectiveness,

b. System interrupting PM--PM that degrades system operational effectiveness.

Corrective Maintenance - All actions performed as a result of failure, to restore an item to a specified condition.

## 10.5 TRAFFIC DATA ANALYSIS STATISTICS

I Univariate descriptive statistics may include frequency tables, arithmetic

mean, standard deviation, variance, mode (values at which the frequency density is at a maximum) and median. Other statistics for a single variable may be included.

a. Generally, univariate descriptive statistics apply to the classes of data listed in the following paragraph numbers:

1. 3.5.4.2.4.2(a) (1), (4) throught (7),

2. 3.5.4.2.4.2(b) (1), (2) and (4),

3. 3.5.4.2.4.2(c) (3).

b. Frequency distribution and regression/trend analysis are applicable to para. 3.5.4.2.4.2(a) (2). Specifically, with time of day and number of calls in system as independent variables, correlate the number of (a) blocked calls, (b) lost calls, (c) delayed calls, (d) uncompleted calls, (e) busy tone terminations, (f) answered calls, and (g) unanswered calls.

c. Distribution and regression analysis are applicable to the following items listed in para. 3.5.4.2.4(a) (3) with time of day as one but not necessarily the only independent variable: monitoring, call forwarding, HS/LS selection, brightness, preemption, cross-coupling, results, BUEC selection.

d. The following classes of data listed in para. 3.5.4.2.4.2(b) (3) may be analysed by calculating the following: (a) distribution of the number of calls in.the queue as a function of time of day, and (b) regression analysis of time calls are in queue as a function of number of calls in the queue and time of day.

e. Regression analysis is applicable to the following classes of data listed in para. 3.5.4.2.4.2(c): (a) trunk loading as a function of time of day and number of calls in system, (b) trunk overloading as a function of time of day and number of calls in system, (c) throughput timing as a function of time of day and number of calls in system.

f. Distribution of the following data items listed in para. 3.5.4.2.4.2(d) is applicable: (a) frequency of use of reconfiguration function and position relief recording as a function of time of day, (b) occurrence of calls in progress during reconfiguration as a function of time of day, (c) frequency of occurrence of position relief recording as a function of position relief briefing time, (d) frequency of occurrence of reconfiguration function as a function of reconfiguration time.

g. Computation of the sample correlation coefficient as a measure of the accuracy of estimate is recommended. Analysis of variance may also be applied to distribution calculations.

## Trend

A trend is the long-term movement of a time series. One method of determining a trend is the method of least squares.

mean, standard deviation, variance, mode (values at which the frequency density is at a maximum) and median. Other statistics for a single variable may be included.

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d. The following classes of data listed in para. 3.5.4.2.4.2(b) (3) may be analysed by calculating the following: (a) distribution of the number of calls in.the queue as a function of time of day, and (b) regression analysis of time calls are in queue as a function of number of calls in the queue and time of day.

e. Regression analysis is applicable to the following classes of data listed in para. 3.5.4.2.4.2(c): (a) trunk loading as a function of time of day and number of calls in system, (b) trunk overloading as a function of time of day and number of calls in system, (c) throughput timing as a function of time of day and number of calls in system.

f. Distribution of the following data items listed in para. 3.5.4.2.4.2(d) is applicable: (a) frequency of use of reconfiguration function and position relief recording as a function of time of day, (b) occurrence of calls in progress during reconfiguration as a function of time of day, (c) frequency of occurrence of position relief recording as a function of position relief briefing time, (d) frequency of occurrence of reconfiguration function as a function of reconfiguration time.

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